Evaluation of Supersonic Gas Separation Technology for Recovery of Natural Gas Liquids from Natural Gas

by

Do Ngan Quynh

Dissertation submitted in partial fulfillment of
the requirements for the
Bachelor of Engineering (Hons) Chemical Engineering

JANUARY 2009

Universiti Teknologi Petronas
Bandar Seri Iskandar
31750 Tronoh
Perak Darul Ridzuan

CERTIFICATION OF APPROVAL

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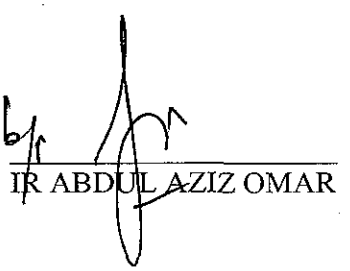
Approved by,

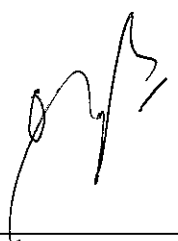


IR ABDUL AZIZ OMAR

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
JANUARY 2009

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgments, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.



DO NGAN QUYNH

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ABSTRACT

Natural gas has long become an indispensable source of energy throughout most of the world thanks to its friendliness to the environment. Worldwide natural gas consumption is rapidly increasing. However natural gas is a non-renewable energy source, the extensive utilization will lead to a new kind of energy crisis, the natural gas crisis. This fact has resulted in the need to improve the performance of natural gas processing, maximize the outputs while minimizing the inputs. With the end uses as fuel or industrial feedstock, Natural Gas Liquids (NGLs) are among the valuable by-products from natural gas processing operations. It is therefore essential to study, validate and apply new technology to enhance the performance of the NGL recovery process.

With this background, my final year simulation-based project is developed with the aim at assessing the theoretical viability of Twister™, a new technology for recovery of NGLs from natural gas, and comparing it with a traditional turbo-expander system. The project's objectives are:

1. To study the viability of applying the supersonic gas separation technology for deep Natural Gas Liquids recovery
2. To evaluate and compare the performance of Twister™ against a conventional turbo-expander system.
3. To identify Twister's range of applicability for NGL recovery

The project scope involves evaluating the performance of a Twister™ against a conventional turbo-expander for NGL recovery by simulating the processes by HYSIS model of both systems.

Variety of feed compositions, temperatures and pressures which represent the possible ranges of feed conditions in the actual gas plants are employed in the study to produce comprehensive results. In overall, it is found out that Twister is more efficient than turbo-expander, especially in the cases of feed which is rich in heavy hydrocarbons. Further analyses should be conducted to get more comprehensive conclusions.

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CHAPTER 1

INTRODUCTION

1.1. Project Background

Since its discovery, natural gas has become an indispensable source of fuel throughout most of the world. The use of natural gas offers a number of environmental benefits over other sources of energy, particularly over other types of fossil fuels. Although the value of natural gas is primarily derived from methane which constitutes approximately 70% to 90% its composition (depending on the gas reservoir), the recovery of other by-products such as Natural Gas Liquids (NGLs) or Sulfur (typically abundant in sour gas reservoir) will bring significant additional value to the whole natural gas extraction process.

Natural Gas Liquids (NGLs) refers to the mixture of ethane, propane, butane and natural gasoline extracted from natural gas. The economic values of the separated NGL components when sold as chemical feedstock are usually much higher than their value as fuel. There are two principle techniques typically utilized for removing NGLs from natural gas stream: the absorption method and the cryogenic expander process. According to the Gas Processors Association, these two processes account for around 90% of total natural gas liquids production [1].

In addition to the above-mentioned traditional methods, an emerging technique which has recently been applied in the gas processing industry is the Twister™ supersonic gas separation system. The first commercial Twister™ application was introduced in December 2003, on the PETRONAS/Shell-cooperated platform B-11 offshore East Malaysia.

Genesis Oil and Gas Consultants Ltd has performed a third party simulation study to compare the condensate recovery performance of Twister™ and a conventional Joule-Thomson system [2]. However this paper had focused only on moderate NGL recovery. When deep NGL recovery is required, a turbo-expander in tandem with demethanizer column is recommended. My simulation-based final year project is being carried out to evaluate the performance and benefits of a Twister™ NGL recovery system compared to a turbo-expander.

1.2. Problem Statement

1.2.1. Problem Identification

Worldwide natural gas consumption is rapidly increasing. According to EIA, Department of Energy, U.S Government, global consumption of natural gas is projected to increase by nearly 64% between 2004 and 2030 (96.2 to 158 trillion cubic feet). However natural gas is a non-renewable energy source, the extensive utilization will eventually lead to a global natural gas crisis. This fact has resulted in the necessity as a pre-emptive action to improve the efficiency of the natural gas processing as well as to optimize the process output. With the end uses as fuel or industrial feedstock, NGLs are among the valuable by-products from Natural Gas Processing Operations. It is therefore essential to study, validate and apply new technology to enhance the performance of the NGL recovery process.

1.2.2. Significance of the Project

This simulation-based project focuses on evaluating and comparing the NGL recovery performance of a conventional turbo-expander system with Twister™, a newly developed supersonic gas separation technology. A study by Genesis Oil and Gas Consultants Ltd has proven that Twister™ performs more efficiently than a Joule Thomson - Low Temperature Separator system with moderate NGLs recovery requirement [2]. However Twister™ efficiency has not yet been studied and validated when deep NGL recovery is required. If it could be proven that Twister™ may outperforms the turbo-expander system, the newly invented supersonic gas separation technology would gain more acceptance and be more widely applied in the industry.

1.3. Objectives of the project

1.3.1. To study the viability of applying the supersonic gas separation technology for deep Natural Gas Liquids recovery

1.3.2. To evaluate and compare the performance of Twister™, a supersonic gas conditioning technology, against a conventional turbo-expander system.

1.3.3. To identify Twister's range of applicability for NGL recovery

1.4. Scope of study

This simulation-based project aims at assessing the theoretical viability of Twister™ for deep recovery of NGLs from natural gas. Specifically, the project scope involves evaluating the performance of a Twister™ against a conventional turbo-expander for NGL recovery by simulating the processes by HYSIS model of both systems. The project will be carried out in three (3) phases and completed within the time frame of 20 weeks (refer to Chapter 3, Methodology for details).

CHAPTER 2

LITERATURE REVIEW

2.1. Natural Gas Liquids

According to Abdel-Aal, Aggour & Fahim (2003):

Natural gas obtained from natural underground reservoirs either as free gas or gas associated with crude oil generally contains large amounts of methane (CH_4) along with decreasing amount of other hydrocarbons. The term NGL (natural gas liquids) is a general term which applies to liquids recovered from natural gas and as such refers to ethane and heavier products (C_3+). It is generally desirable to recover NGL present in the gas in appreciable quantities. In some cases, ethane C_2 could be separated and sold as a petrochemical feed stock. NGL recovery is the first operation in stage II of Gas Processing, refer to Figure 1 below. To recover and separate NGL from a bulk of a gas stream would require a change in phase; that is, a new phase has to be developed for separation to take place by using one of the following:

- An energy-separating agent (ESA); examples are refrigeration for partial or total liquefaction and fractionation.
- A mass-separating agent (MSA); examples are adsorption and absorption (using selective hydrocarbons, 100–180 molecular weight).

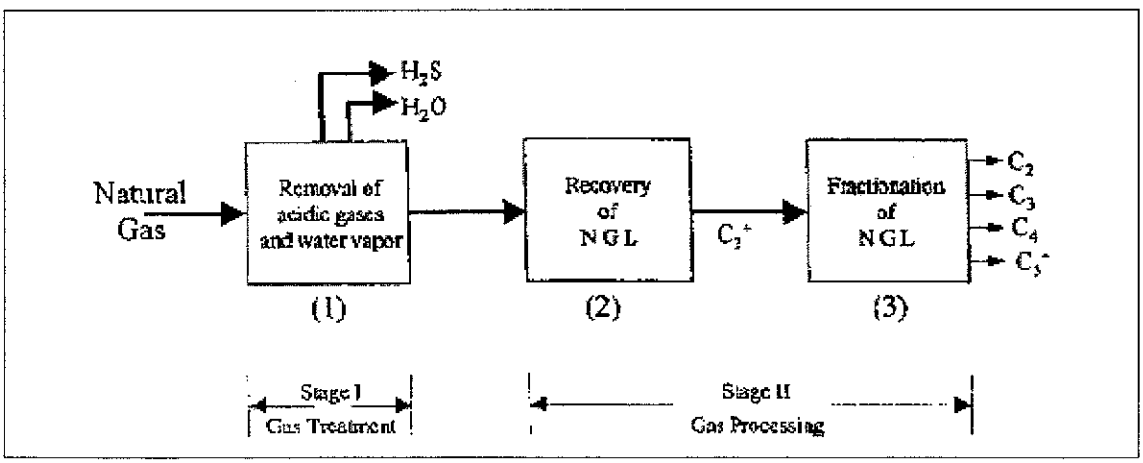

Figure 1: *Operations involved in the treatment and processing of natural gas*

2.2. Recovery and Separation of Natural Gas Liquids

2.2.1. Absorption process

The absorption unit consists of two sections: the absorption and regeneration as illustrated in Figure 2. An upflow natural gas stream is brought in direct contact, countercurrently with the solvent (light oil in the kerosene boiling range) in the absorber. The column—a tray or packed one—operates at about 400–1000psia and ambient or moderately sub-ambient temperatures. The rich oil (absorbed NGL plus solvent) is directed to a distillation unit to separate and recover the NGL, whereas the lean oil is recycled back to the absorber. In addition to natural gasoline, C3/C4 could be recovered as well in this process. Provision is made to separate ethane from rich oil using a deethanizer column. Ethane recovery, however, is quite small. This process is being phased out.

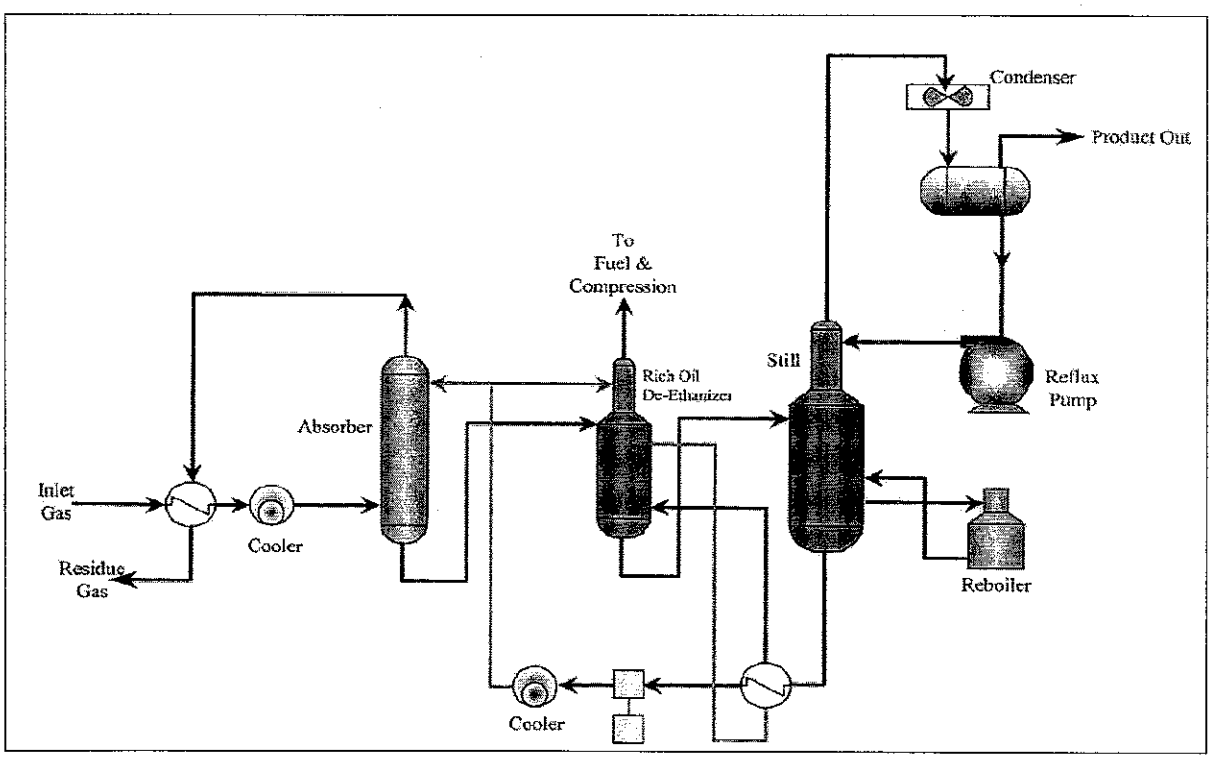

Figure 2: *Separation of NGL by absorption*

2.2.2. Turbo-expander system

Turbo expander process uses the feed gas pressure to produce needed refrigeration by expanding the high pressure gas across a turbine (turbo-expander) to abruptly drop high pressure gas to lower pressure thus dropping its temperature (PV/T effects). The turbo-expander can recover useful work from this expansion. Typically the expander is linked to a centrifugal compressor to recompress the residue gas from the process which saves compression energy of other processes. Due to the nature of the expansion is near isentropic, the turbo-expander lowers the gas temperature significantly more than expansion across a typical J-T valve.

A simplified schematic diagram of a turbo-expander system is shown in Figure 3 [3]. The inlet gas to the demethanizer is first cooled to about −51°C against the residue gas in a heat exchanger (referred to as a cold box) which partially condenses the inlet gas. The resultant gas-liquid mixture is then separated into a gas stream and a liquid stream.

The liquid stream from the gas-liquid separator flows through a valve and undergoes a throttling expansion from an absolute pressure of 62bar to 21bar, which is a constant enthalpy process which results in lowering the temperature of the stream approximately from about −51°C to −81°C at the inlet of the demethanizer.

The gas stream from the gas-liquid separator enters the turbo-expander where it undergoes an isentropic expansion from an absolute pressure of 62bar to 21bar which further lowers the gas stream temperature from about −51°C to about −91°C as it enters the demethanizer to serve as distillation reflux.

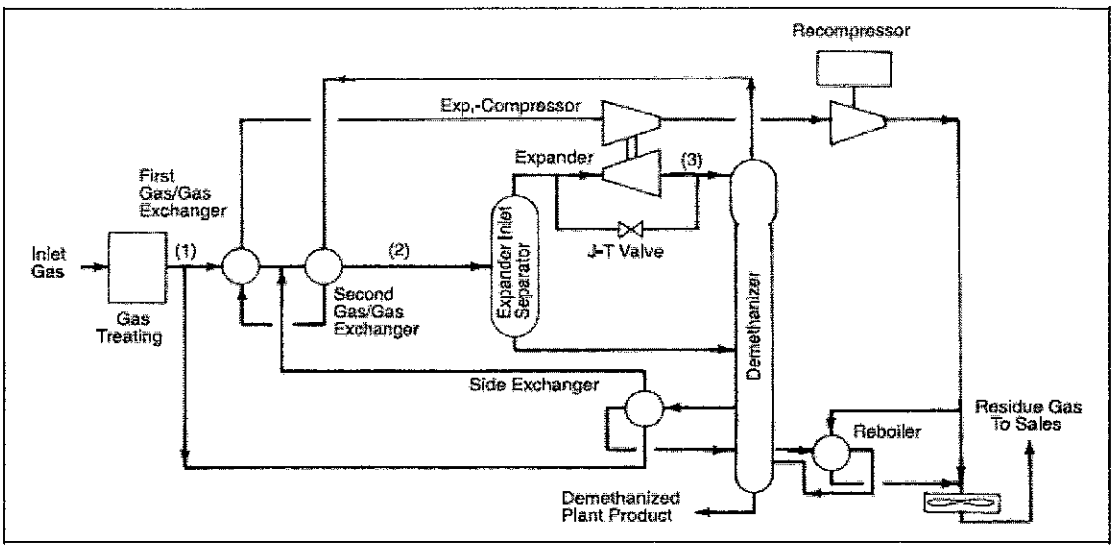

Figure 3: *A schematic diagram of a demethanizer extracting hydrocarbon liquids from natural gas*

Liquid from the top tray of the demethanizer (at about −90°C) is routed through the cold box where it is heated to about 0°C as it cools the inlet gas, and is then returned to the lower section of the demethanizer. Another liquid stream from the lower section of the demethanizer (at about 2°C) is routed through the cold box and returned to the demethanizer at about 12°C. In effect, the inlet gas provides the heat required to re-boil the bottom of the demethanizer and the turbo-expander removes the heat required to provide reflux in the top of the demethanizer.

The overhead gas stream from the demethanizer at about −90°C is processed natural gas that is of suitable quality for distribution to end-user for consumption. It is routed through the cold box where it is warmed as it cools the inlet gas. It is then compressed in the gas compressor which is driven by the turbo expander and further compressed in a second-stage gas compressor driven by an electrical motor or gas turbines before entering the distribution pipeline.

The bottom product from the demethanizer is also warmed in the cold box, as it cools the inlet gas, before it leaves the system as NGLs.

2.2.3. Thermodynamic description of Turbo Expander Process

An isentropic process is a constant entropy process. If a control mass undergoes a process which is both reversible and adiabatic, then the second law specifies the entropy changes to be zero. A steady state reversible flow through an adiabatic controlled volume also has no entropy change from inlet to outlet. Both are isentropic processes. Although an isentropic process might be an idealization of an actual process, it serves as a limiting case, for particular applications. The entropy change for an ideal gas can be presented as:

$$s_2 - s_1 = \int_{T_1}^{T_2} c_v \frac{dT}{T} + R \ln \frac{v_2}{v_1}$$

$$s_2 - s_1 = \int_{T_1}^{T_2} c_p \frac{dT}{T} - R \ln \frac{P_2}{P_1}$$

For such isentropic process, S_2-S_1 = 0:

$$0 = \int_{T_1}^{T_2} c_v \frac{dT}{T} + R \ln \frac{v_2}{v_1}$$

$$0 = \int_{T_1}^{T_2} c_p \frac{dT}{T} - R \ln \frac{P_2}{P_1}$$

The final form used depends on the approximation made for the temperature dependence of the specific heats. Assuming that the specific heats are accurately approximated by constant values eliminates the integrals in the above equations. The constant specific equations are:

$$0 = c_v \ln \frac{T_2}{T_1} + R \ln \frac{v_2}{v_1} \Rightarrow \left(\frac{T_2}{T_1}\right)_s = \left(\frac{v_2}{v_1}\right)_s^{-R/c_v} = \left(\frac{v_1}{v_2}\right)_s^{R/c_v}$$

$$0 = c_p \ln \frac{T_2}{T_1} - R \ln \frac{P_2}{P_1} \Rightarrow \left(\frac{T_2}{T_1}\right)_s = \left(\frac{P_2}{P_1}\right)^{R/c_p}$$

Where, the subscript s indicates that the process occurs at constant entropy. The power on each expression is rewritten:

$k = C_p/C_v$ and C_p-C_v = R, so $R/C_p = (k-1)/k$.

Thus we get:

$$\left(\frac{T_2}{T_1}\right)_s = \left(\frac{v_1}{v_2}\right)_s^{k-1}$$

$$\left(\frac{T_2}{T_1}\right)_s = \left(\frac{P_2}{P_1}\right)^{\frac{k-1}{k}}$$

These equations are specified relations that are used for an ideal gas undergoing ideal process if the specific heats are considered to be constant. If the specific heat cannot be assumed as constants then the temperature dependence of the specific heats must be included. The variable specific heat solution for an ideal gas undergoing an isentropic process is obtained as:

$$s_2 - s_1 = 0 = s_0(T_2) - s_0(T_1) - R\ln\frac{P_2}{P_1}. \text{ (Holman J.P., 1988)}$$

2.3. Twister™ Supersonic Gas Separation

Twister™ is a gas conditioning technology introduced by Twister BV, a Shell-affiliated company. Currently this gas conditioning technology can be utilized to simultaneously condense and separate water and various hydrocarbons from natural gas. Refer Figure 4 below for a cross-sectional view of a Twister tube.

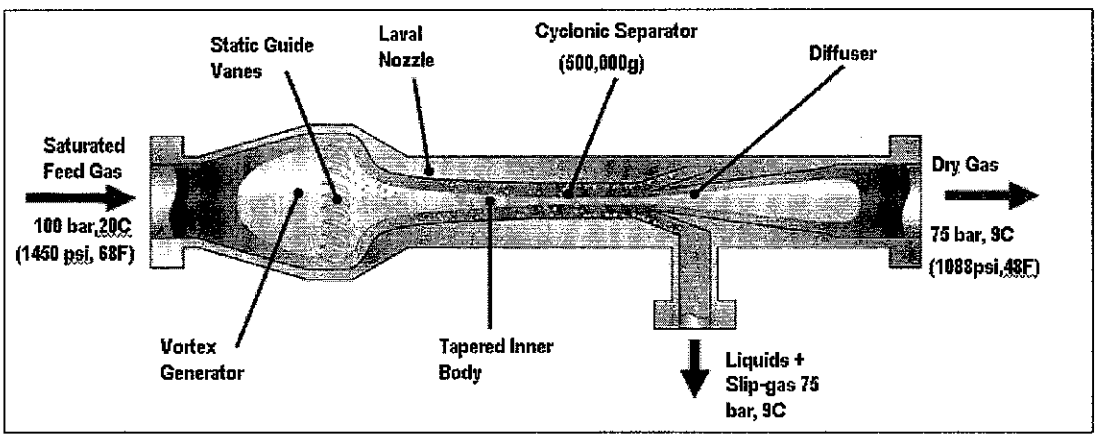

Figure 4: *Twister™ - cross-sectional view of a Twister tube*

The wet gas stream enters the separator at around 100bar and 20°C. In the first stage of Twister, the gas passes through a Laval nozzle, a converging/diverging tube with precise geometry which raises velocity to supersonic levels which causes a sharp fall in temperature. Passing through the nozzle, the gas is expanded adiabatically – with no loss or gain of heat - and near isentropically - almost at constant entropy, about 90% efficient. In thermodynamic terms, the overall effect is classed as a reversible flow process. Therefore the thermodynamic description of Twister™ is similar to that of turbo-expander system.

At the throat of the Laval nozzle, stream velocity is raised above Mach 1, typically to around 350-400m/s, although velocity up to Mach 3 is possible. Simultaneously, the temperature of the gas stream plummets. Although beyond the throat the gas is now gradually expanding in the nozzle, the thermodynamics of supersonic flow work 'in reverse', continuing to accelerate the flow and drop the temperature, such that by the time the gas stream reaches the entry to the next stage of the process, its temperature would have fallen by 50°-80°C compared with inlet conditions.

Falling temperatures create a fog of condensing liquids, a mixture of very fine water and heavier hydrocarbon droplets, microns in diameter. In most process plants these conditions would be ripe for unwelcome hydrate formation requiring chemical suppression, but not so in Twister. The residence time in the equipment is so short, less than one hundredth of a second, that hydrate crystals do not have sufficient time to form.

The gas and liquid droplets next enter the wing section of the tube. This is a delta-shaped projection - similar to the wing of a fighter aircraft - which creates lift and imparts a swirling motion to the flow. Liquid droplets are thrown to the inner wall of the tube, forming a thin film only millimeters thick, which is removed through either a co-axial tube or circumferential slits in the tube wall. Once drained from the main gas flow, water and hydrocarbons can be routed to a conventional liquid/liquid separation.

The dry gas stream continues through the tube, entering a diffuser section. Flow velocity is now returned to subsonic levels - a weak shock wave occurs naturally as

the flow begins to slow down, with 70-80% of the initial gas pressure being recovered.

In short, Twister™ Supersonic Separator has similar thermodynamic characteristics to a turbo-expander, combining expansion, cyclonic gas/liquid separation and re-compression in a compact, static, tubular device however at a different efficiency. A turbo-expander transforms pressure to shaft power; whereby Twister™ achieves a similar temperature drop by transforming gas pressure to kinetic energy. Twister™ system could be simplified and represented by using three basic systems – an expander, a normal separator and a compressor (Figure 5) combined into one.

Figure 5: *Simplified Twister™ operating principles*

Figure 6 shows a typical process flow diagram of the system. The technology is a low-temperature separation process; inlet cooling can optimize performance. This can be achieved by heat integration using the cold exit gas, supplemented with air or seawater for cooling if required (with no moving parts and chemical utilization, Twister™ has possibilities for subsea application where the deep seawater could be used as cooling medium). The inlet separator upstream of the supersonic tubes is designed to remove produced liquids and prevent carryover of slugs and solids.

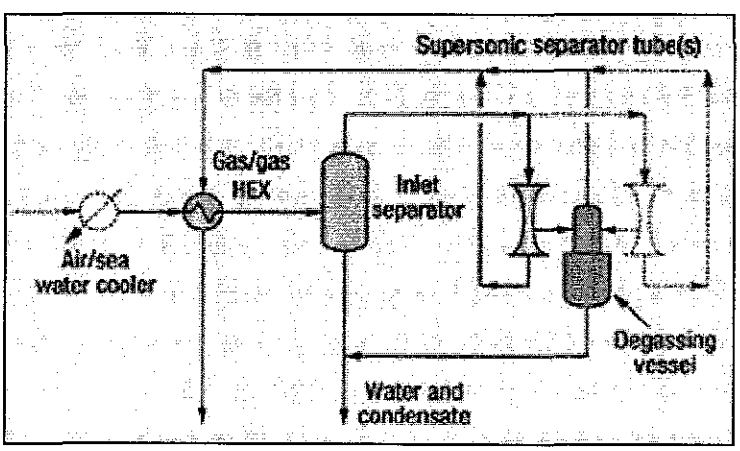

Figure 6: *Twister™ - Typical process flow*

CHAPTER 3

METHODOLOGY

3.1. Project procedure

As illustrated in the figure below (Figure 7), the project will be implemented in three phases.

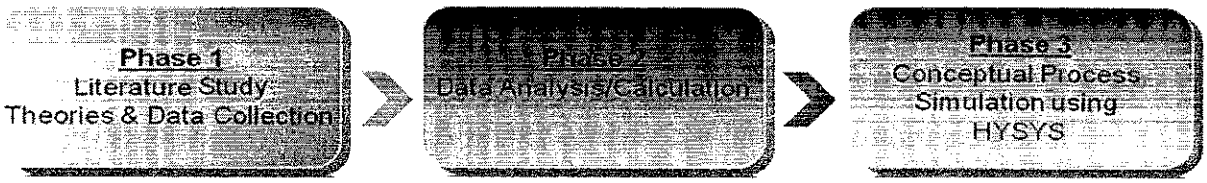

Figure 7: *Research methodology*

At the initial phase of the project, the theories, data and published papers related to the working conditions of the turbo-expander and Twister™ systems are collected and studied. A wide range of commercialized data, operation principles and conditions, benefits and applications of the systems are expected to be obtained to aid the simulations in the HYSYS environment in the next phase.

Based on the knowledge acquired and the data collected in the previous phase, the project will then be carried on with the computation of inlet flow rate, inlet pressure (based on the inlet temperature), mass fractions of the inlet components. A range of feed conditions which represent the likely spread of operating parameters in different NGL recovery systems in gas plants worldwide will be studied.

The HYSYS models simulating and analyzing the turbo-expander and Twister™ systems are then developed. Based on these models, the amount of NGLs recovered from natural gas can be easily determined, which leads to the conclusion about the feasibility of applying Twister™ in deep NGL recovery through simulation.

The project is estimated for completion in 20 weeks. Refer to the timeline below.

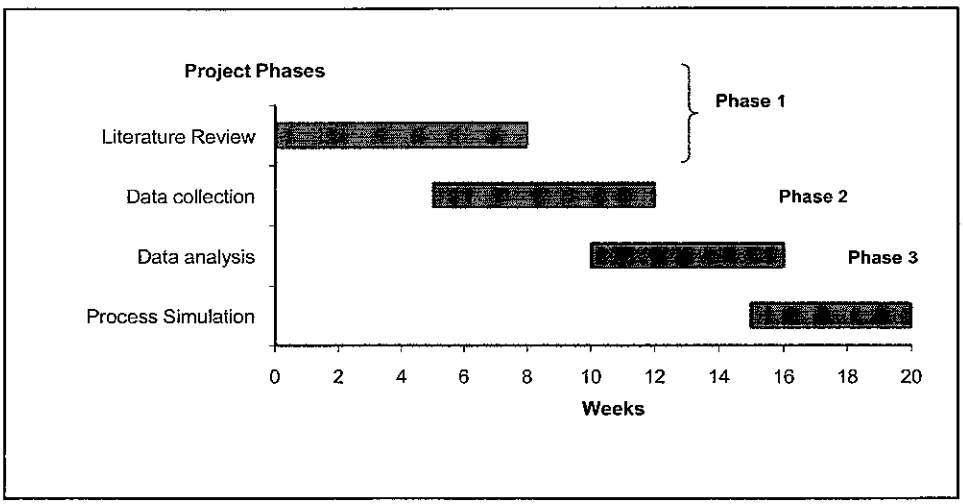

Figure 8: *Research schedule and timeline*

3.2. HYSYS – Major tool of simulation and analysis

Aspen HYSYS 3.2 is a process modeling tool for steady state simulation, design, performance monitoring, optimization and business planning for oil and gas production, gas processing and petroleum refining industries. The program is built upon proven technologies, with more than 25 years experience supplying process simulation tools to the oil, gas and refining industries. It proves an interactive process modeling solution that enables engineers to create steady state models of plant design, performance monitoring, troubleshooting, operational improvement, business planning, and asset management. HYSYS helps process industries improve productivity and profitability throughout the plant lifecycle. The powerful simulation and analysis tools, real-time applications and the integrated approach to the engineering solutions enable the user to improve designs, optimize production and enhance decision-making (Aspen Tech, 2004). HYSYS offers a high degree of flexibility because there are multiple ways to accomplish specific tasks. This flexibility combined with consistent and logical approach to how these capabilities are delivered makes HYSYS a versatile process simulation tool (Aspen Tech, 2004). Another HYSYS feature is that modular operations are combined with non-sequential solution algorithm, so not only is information processed as it is supplied, but the results of any calculation are automatically produced throughout the flow

sheet, both forwards and backwards. The modular structure of the operation means they can be calculated in either direction, using information in an outlet stream to calculate inlet conditions (Aspen Tech, 2004).

3.3. Simulation parameters

A range of feed temperatures and pressures will be taken into consideration in the study to represent the probable range of the operating conditions in different NGL recovery systems in gas plants worldwide. The variations of these parameters are as follows:

a. Feed pressure: 100bar and 70bar, representing the normal range of feed pressures for NGL recovery systems

b. Feed temperature: 25°C, 35°C and 40°C, representing the likely range of cooler outlet temperatures in the gas plants

c. Pressure loss: 20% of the feed pressure (minimum of Twister range) and 30% (maximum of Twister range)

d. Feed compositions: Three feed gas compositions are selected for study, namely 'rich', 'normal' and 'lean' [3]. These are presented in Table 1.

Table 1: *Feed Compositions*

	Rich	Normal	Lean
C1 (mol %)	82.00	87.00	92.00
C2	9.70	7.90	4.80
C3	4.50	3.30	1.80
IC4	0.50	0.46	0.49
NC4	1.80	1.13	0.87
IC5	0.50	0.00	0.00
NC5	0.49	0.21	0.04
C6+	0.51	0.00	0.00

Peng-Robinson Equation Propety Package is used for the simulation in HYSYS environment. Physical properties are predicted by HYSYS using the following thermodynamic based equations:

[3] *Source:* Kidnay, A.J & Parrish, W. (2006), *Fundamentals of Natural Gas Processing*, CRC Press, Taylor & Francis Group and Genesis Oil & Gas Consultants Ltd (Nov 2007). *Twister NGL Recovery Study*

$$\frac{H-H^{ID}}{RT} = Z-1+\frac{1}{RT}\int_{\infty}^{V}\left[T\left(\frac{\partial P}{\partial T}\right)\Big|_{V}-P\right]dV$$

$$\frac{S-S_o^{ID}}{RT} = \ln Z-\ln\frac{P}{P^o}+\int_{\infty}^{V}\left[\frac{1}{R}\left(\frac{\partial P}{\partial T}\right)\Big|_{V}-\frac{1}{V}\right]dV$$

Where the Ideal Gas Enthalpy basis (H^{ID}) used by HYSYS is equal to the ideal gas Enthalpy of Formation at 25°C and 1 atm. The Ideal Gas Enthalpy basis (H^{ID}) used by HYSYS changes with temperature according to the coefficients on the Tdep tab for each individual component.

3.4. Simulation assumptions

a. It is assumed that the design presented here is not a stand-alone NGL recovery plant; which indicates that the feed stream prior to entering into NGL recovery plant has been dehydrated and pre-treated beforehand. Therefore there are no drying and solid particle removal units being included.

b. In this project, the feed pressure of 100bar and 70bar which are the normal range of feed pressures for NGL recovery systems are taken into consideration; so it is assumed that these pressure are high enough for achieving optimal recovery, therefore neither refrigeration system nor pre-compressor is incorporated in the process flow.

c. A pressure loss of 0.5bar is assumed across the heat exchanger (for both tube side and shell side of the heat exchanger).

CHAPTER 4

RESULTS AND DISCUSSION

In summary, there are 36 operating cases being defined and simulated. They are comprised of three different feed sources, each source having twelve distinct operating conditions which include three sets of feed temperature, two different feed pressures and two different values of pressure drop.

4.1. Simulation works

4.1.1. Turbo-expander system

The inlet gas enters the plant after being dehydrated to prevent hydrate formation under cryogenic conditions. The feed is first cooled in gas-gas heat exchanger with exiting cold gas S10 from the top of the demethanizer column; then it is sent to a separator where the vapor stream S6 is separated from the condensed liquid S7.

The vapor stream S6 enters the turbo-expander in which it expands the vapor isentropically from very high pressure to a pressure of 30bar, with the work expansion cooling the expanded stream S8 to a temperature of approximately -60°C. The work recovered is used to drive the centrifugal expander compressor.

The expanded and partially condensed stream S8 is fed to the demethanizer tower at upper mid-column point.

The condensed liquid S7 from the separator S7 is passed to a valve prior to feeding to the distillation column as reflux.

The demethanizer distills the cold liquid and gas fed to the tower. The overhead gas S10 is highly concentrated in methane with an insignificant portion of ethane. It is considered as processed natural gas that is of suitable quality for distribution to end-users for consumption. Before entering the distribution pipeline, it is routed through a gas-gas heat exchanger to cool the inlet gas and then compressed in a compressor which is driven by the turbo expander. The column bottom is the NGL product stream with primarily ethane and propane.

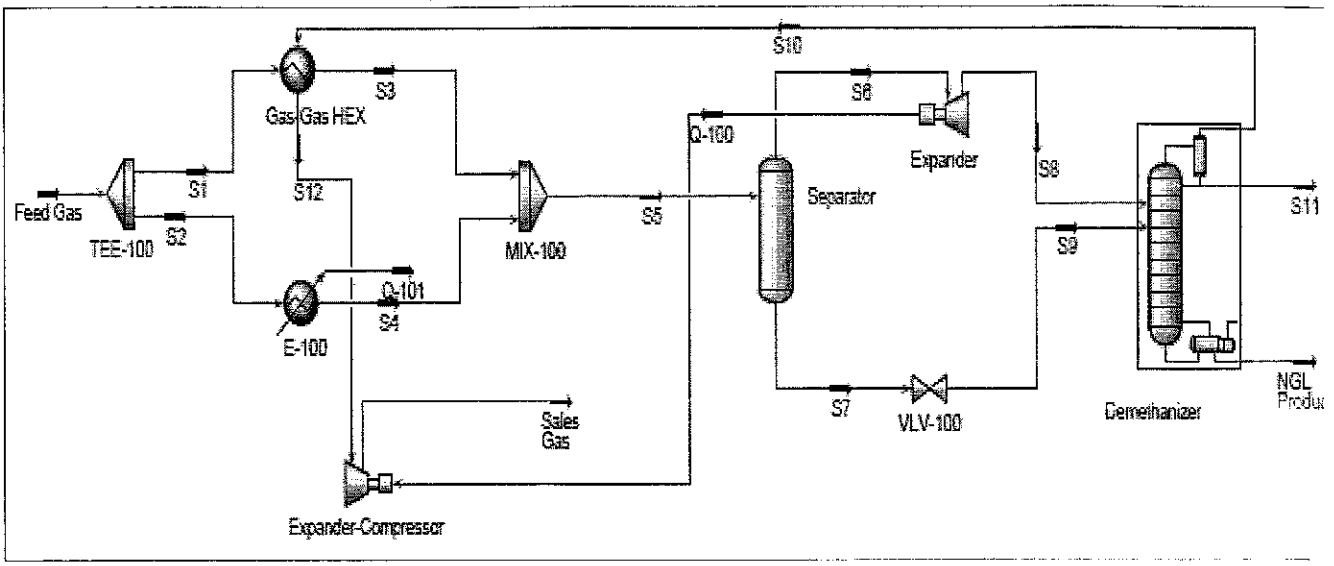

Figure 9: *Process flow diagram of Turbo-expander system*

4.1.2. Twister system

Based on the operating principles explained in Chapter 2, a simplified process flow diagram for Twister system was developed and shown in Figure, this flow diagram will be the basis for the simulation analysis.

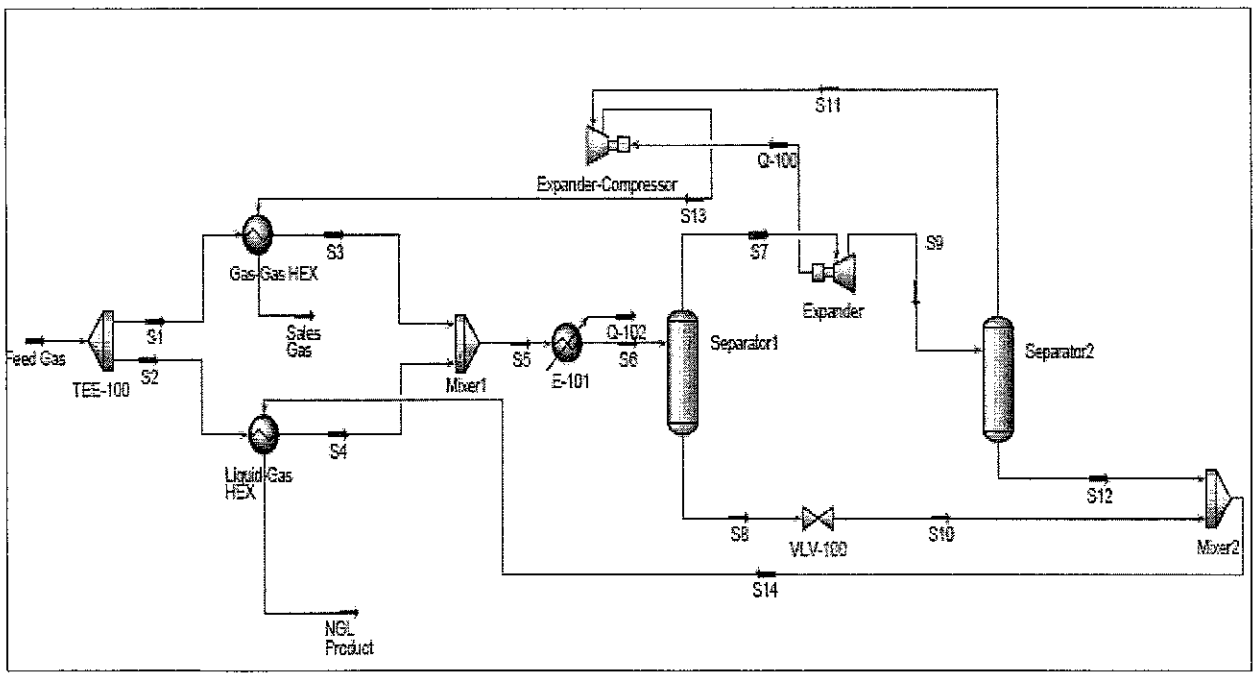

Figure 10: *Process flow diagram of Twister system*

The feed gas stream is first split into two streams S1 and S2 with the ratio of 7:3. S1 then passes through the gas-gas heat exchanger against the cold gas from Twister, resulting in partial condensation of the gas stream. The remainder of the gas S2 flows through the liquid-gas heat exchanger and is cooled against the liquids being dropped out from Twister.

These two split streams are recombined and the combined stream, S5, is further cooled down before being sent to the separator where liquids are removed prior to entering Twister to maximize the efficiency of Twister. As the gas stream S7 from the separator enters Twister, it expands to supersonic velocity in Twister tube causing liquids drop out (S12) from the gas stream.

The dry gas stream S11 continues through the tube, entering a compressor with 70-80% of the initial gas pressure being recovered. Flow velocity is now returned to subsonic levels. After compressed, the gas stream S13 is routed to a gas-gas heat exchanger to cool down the feed stream prior to entering the pipeline.

4.2. Feed gas composition

The gas composition has a major impact on the economics of NGL recovery and the process selection. In general, gas with a greater quantity of liquefiable hydrocarbons produces a greater quantity of NGL products and hence greater revenues for the gas processing facility. However richer gas also entails larger refrigeration duties, larger heat exchange surfaces and higher capital cost for a given recovery efficiency. Whereas leaner gases generally require more severe processing conditions (lower temperatures) to achieve high recovery efficiencies. In this study, three different feed gas compositions are employed to perform the process simulation, namely the Rich, the Normal and the Lean feed. Figure 11 and Figure 12 below present the comparative results for the amount of NGL Recovery (C_2+) versus three different feed streams at 25°C and 100bar and at 40°C and 70bar, respectively.

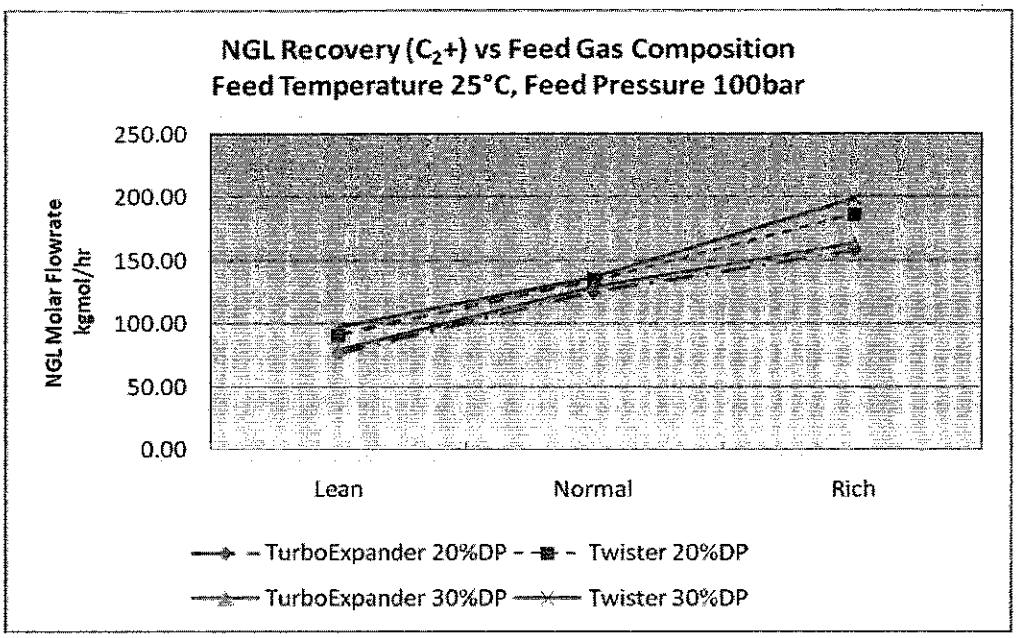

Figure 11: *NGL Recovery versus Feed Gas Composition at 25°C and 100bar*

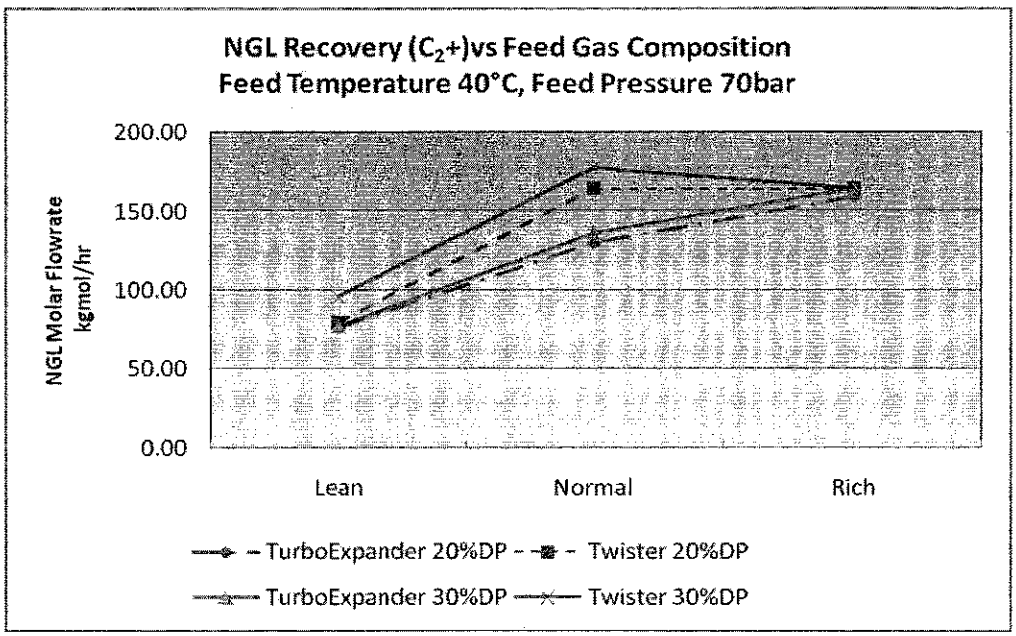

Figure 12: *NGL Recovery versus Feed Gas Composition at 40°C and 70bar*

As being observed from the graphs, Twister system gives better NGL recovery for all cases, regardless of the feed composition and the pressure drop across the system. Whereas the difference in the recovery rate between two systems is insignificant for the lean feed stream, Twister's technology proves to be superior to turbo-expander system for the richer streams. Besides, the graphs show that when the pressure drop across the system is higher, the amount of NGL recovered is also greater. However when taking into account the distribution

and transportation of the product streams, large amount of pressure drop is undesirable as it increases the size and cost of the piping system. Typically, the range of 20% to 30% pressure drop is tolerable and usually employed.

Figure 13 and 14 demonstrate the amount of LPG (the propane and butane mixture) recovered at 25°C and 100bar and 40°C and 70bar, respectively. The same conclusion is drawn from the graph; Twister's performance is better that of Turbo-expander system for recovery of C_3 and C_4 from the natural gas stream.

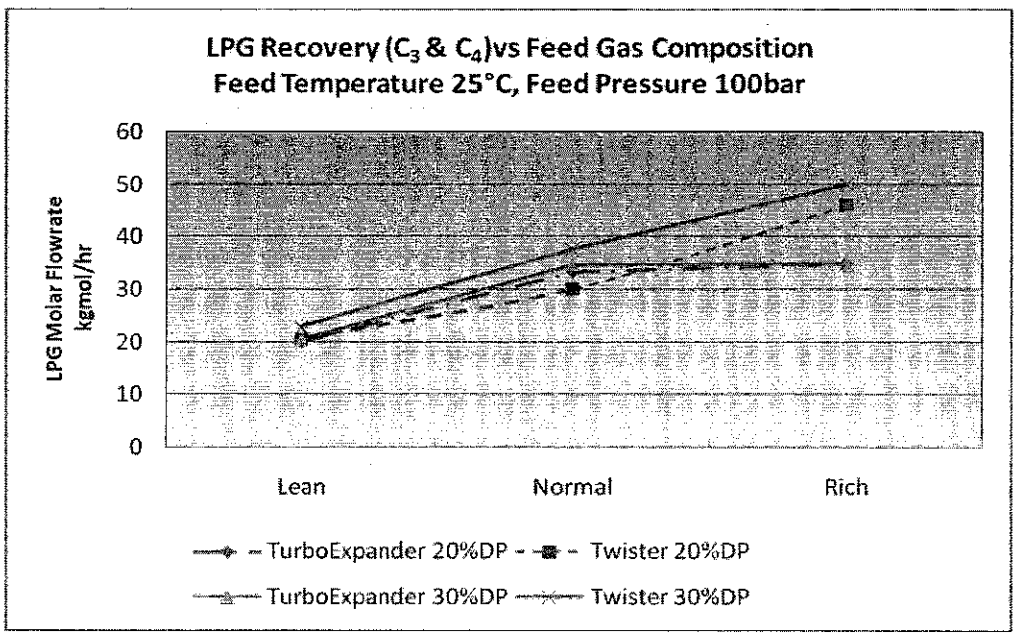

Figure 13: *LPG Recovery versus Feed Gas Composition at 25°C and 100bar*

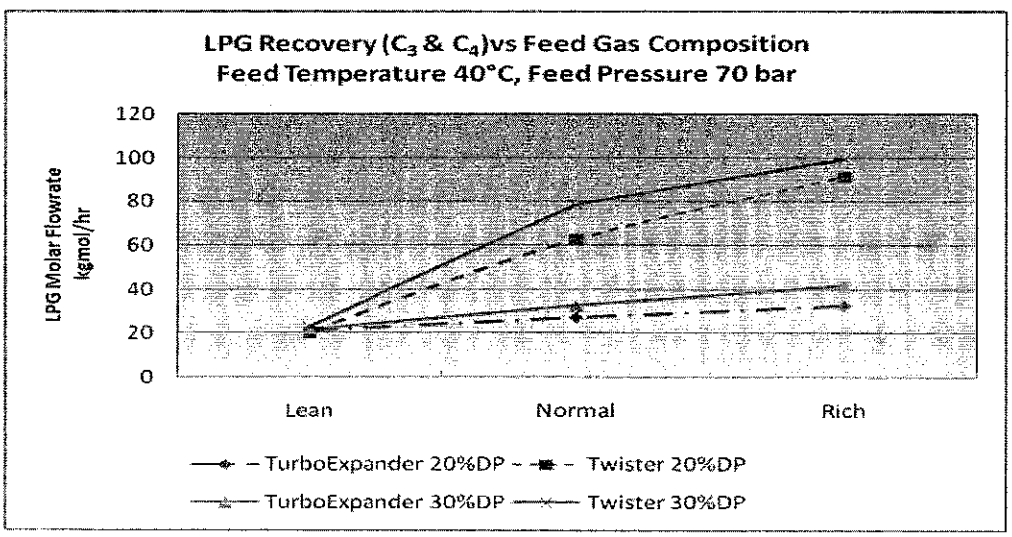

Figure 14: *LPG Recovery versus Feed Gas Composition at 40°C and 70bar*

4.3. Feed Pressure

Theoretically, as both turbo-expander system and Twister system have similar thermodynamic characteristics, both expand the gas isentropically, the quality of the product gas stream and liquid stream will be similar, too. However, as it is illustrated in the simulation, Twister still recovers higher rate of NGL as compared to turbo-expander. The difference is not remarkable in the case of the lean feed but it becomes clearer for the richer feeds.

In addition, for the lean feed, the amount of NGL's recovery does not considerably change as the feed pressure varies. However, for the normal feed and rich feed, it is observed that at constant pressure drop and constant temperature, the higher the feed pressure is, the higher the NGL's recovery rate is.

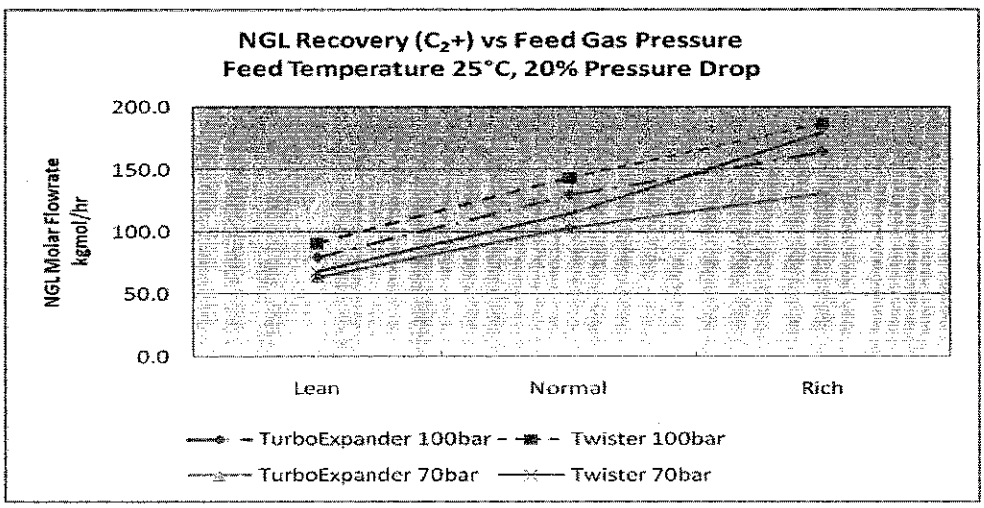

Figure 15: *NGL Recovery versus Feed Gas Pressure*

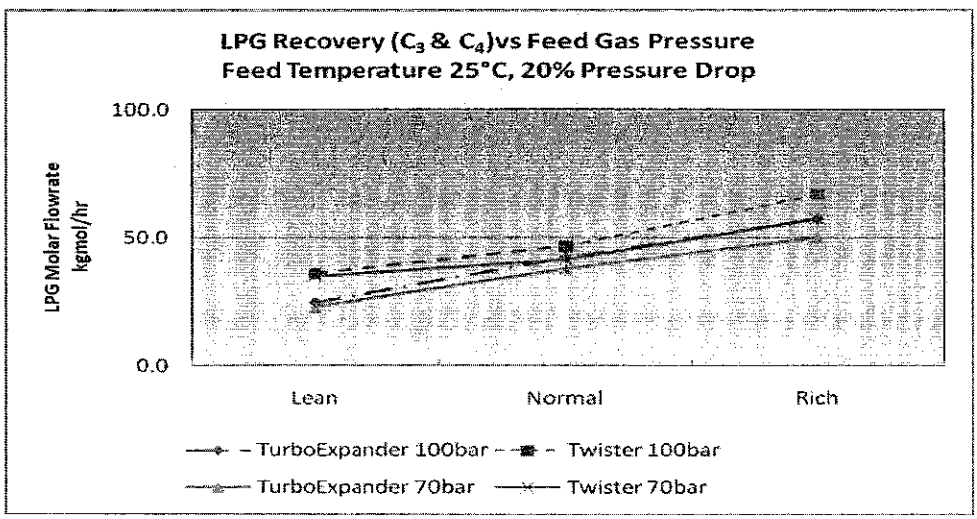

Figure 16: *LPG Recovery versus Feed Gas Pressure*

4.4. Feed Temperature

Figure 17 and 18 show the NGL and LPG production achieved for both systems at different feed temperatures. As obviously shown in the graph, at constant pressure the variation in feed temperature does not greatly influence the recovery rate of liquids. Indeed, feed temperature only has significant effect on the heat integration of the process. However the operation of Twister is not sensitive to temperature change as deeply as that of turbo-expander system, as to yield the optimal liquid recovery rate, the demethanizer tower has to be operated at extremely critical temperature (cryogenic condition).

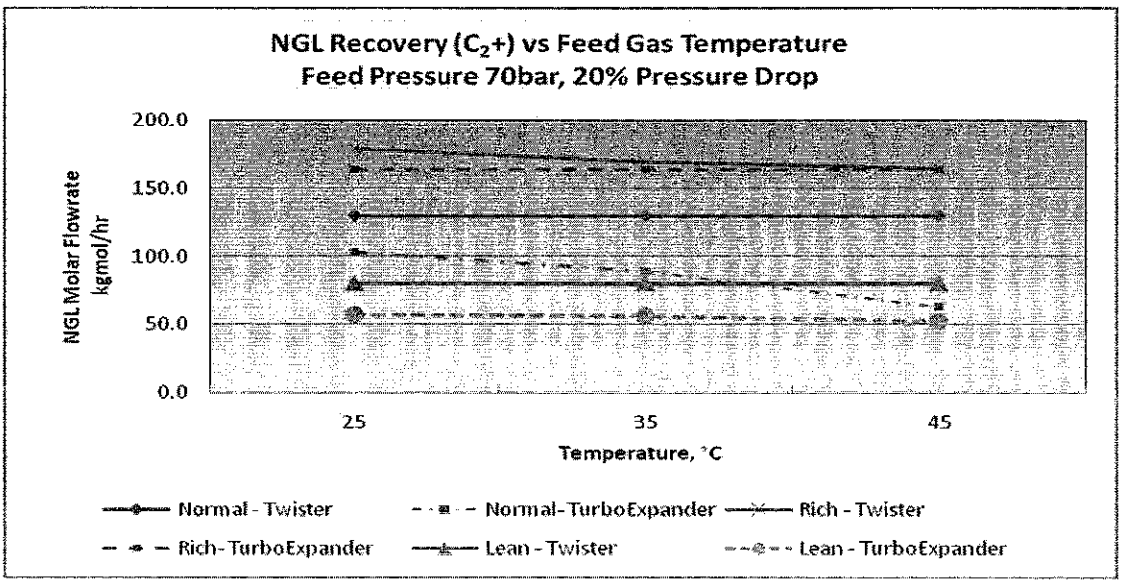

Figure 17: *NGL Recovery versus Feed Gas Temperature*

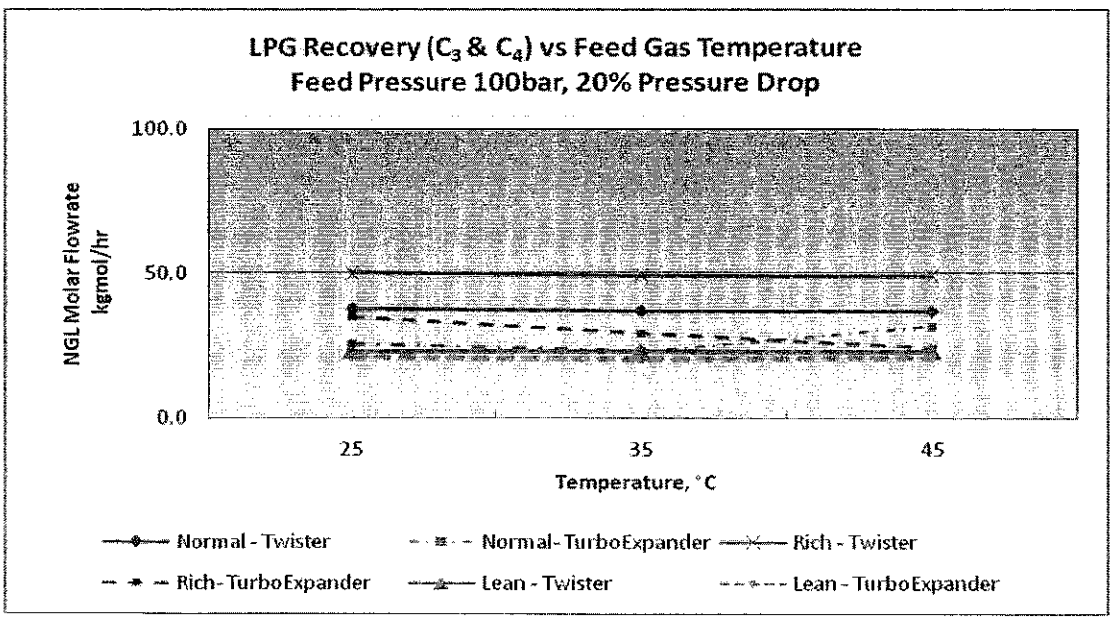

Figure 18: *LPG Recovery versus Feed Gas Temperature*

CHAPTER 5

CONCLUSION AND RECOMMENDATION

Natural gas often contains, in addition to methane and ethane, a substantial quantity of hydrocarbons of higher molecular weight, as for example, propane, butane, and pentane. When processed into finished by-products, these heavier hydrocarbons are collectively referred to as NGLs (natural gas liquids). Recovery of natural gas liquids (NGLs) is desirable because their great value as a chemical feedstock or as fuel.

In most of present processes, propane and the heavier hydrocarbon components of natural gas are separated and recovered by a turbo-expander which performs liquefaction and cryogenic distillation at temperatures below -50°F. In addition to the traditional methods, a newly invented technology which has recently been applied in the industry is the Twister supersonic gas separation system.

This report presents an overview and comparison of the operating principles of a typical turbo-expander and a supersonic gas separation Twister™ system as well as the analysis's results and simulation's outcomes. A range of feed compositions, temperatures and pressures which represent the possible ranges of feed conditions in the actual gas plants are employed in the study to produce comprehensive results. As the results of the analysis, it is figured out that in overall, Twister is more efficient than turbo-expander; however, there is indistinguishable difference between the performance of Twister and turbo-expander with the lean feed cases. In addition, whereas the feed temperature does not cause much change in the rate of NGL's recovery, the feed pressure and feed composition play more important roles. They all follow the same pattern, the higher the feed pressure is, the higher the recovery rate is; and the richer the feed is, the higher the amount of NGL recovered is.

Further simulations and analyses should be conducted to draw more comprehensive and accurate conclusions.

CHAPTER 6

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APPENDIX A

FULL TABULATION OF SIMULATION RESULTS FOR TURBO EXPANDER SYSTEM – RICH FEED STREAM

20% PRESSURE DROP

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	0.99	0.99	0.99	0.82	0.82	0.82	1.00
T [C]	25.00	25.00	25.00	-30.00	-30.00	-30.00	-30.00
P [bar]	100.00	100.0	100.0	99.50	99.50	99.50	99.50
MoleFlow [kgmole/h]	1000.0	700.0	300.0	700.0	300.0	1000.0	816.3
StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	16.39
METHANE [kgmole/h]	820.00	574.00	246.00	574.00	246.00	820.00	678.64
ETHANE [kgmole/h]	97.00	67.90	29.10	67.90	29.10	97.00	76.64
PROPANE [kgmole/h]	45.00	31.50	13.50	31.50	13.50	45.00	34.30
n-BUTANE [kgmole/h]	5.00	3.50	1.50	3.50	1.50	5.00	3.66
n-PENTANE [kgmole/h]	18.00	12.60	5.40	12.60	5.40	18.00	12.61
ISOBUTANE [kgmole/h]	5.00	3.50	1.50	3.50	1.50	5.00	3.70
ISOPENTANE [kgmole/h]	4.90	3.43	1.47	3.43	1.47	4.90	3.46
C6+ [kgmole/h]	5.10	3.57	1.53	3.57	1.53	5.10	3.28

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.81	0.65	1.00	0.00	1.00	1.00	0.00
T [C]	-30.00	-60.00	-66.40	-90.00	-90.00	7.40	30.00	45.40
P [bar]	99.50	30.00	30.00	29.00	29.00	28.50	79.60	29.50
MoleFlow [kgmole/h]	183.71	816.29	183.71	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	3.69	16.39	3.69	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	141.36	678.64	141.36	819.69	0.00	819.69	819.69	0.31
ETHANE [kgmole/h]	20.36	76.64	20.36	16.08	0.00	16.08	16.08	80.92
PROPANE [kgmole/h]	10.70	34.30	10.70	0.00	0.00	0.00	0.00	45.00
n-BUTANE [kgmole/h]	1.34	3.66	1.34	0.00	0.00	0.00	0.00	5.00
n-PENTANE [kgmole/h]	5.39	12.61	5.39	0.00	0.00	0.00	0.00	18.00
ISOBUTANE [kgmole/h]	1.30	3.70	1.30	0.00	0.00	0.00	0.00	5.00
ISOPENTANE [kgmole/h]	1.44	3.46	1.44	0.00	0.00	0.00	0.00	4.90
C6+ [kgmole/h]	1.82	3.28	1.82	0.00	0.00	0.00	0.00	5.10

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	0.83	0.83	0.83	1.00
T [C]	35.00	35.00	35.00	-20.00	-20.00	-20.00	-20.00
P [bar]	100.00	100.00	100.00	99.50	99.50	99.50	99.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	832.13
StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	16.71
METHANE [kgmole/h]	820.00	574.00	246.00	574.00	246.00	820.00	709.45
ETHANE [kgmole/h]	97.00	67.90	29.10	67.90	29.10	97.00	74.27
PROPANE [kgmole/h]	45.00	31.50	13.50	31.50	13.50	45.00	30.42
n-BUTANE [kgmole/h]	5.00	3.50	1.50	3.50	1.50	5.00	2.84
n-PENTANE [kgmole/h]	18.00	12.60	5.40	12.60	5.40	18.00	8.31
ISOBUTANE [kgmole/h]	5.00	3.50	1.50	3.50	1.50	5.00	2.98
ISOPENTANE [kgmole/h]	4.90	3.43	1.47	3.43	1.47	4.90	2.36
C6+ [kgmole/h]	5.10	3.57	1.53	3.57	1.53	5.10	1.50

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.78	0.56	1.00	0.00	1.00	1.00	0.00
T [C]	-20.00	-70.90	-50.80	-90.00	-90.00	-2.00	32.50	45.40
P [bar]	99.50	30.00	30.00	29.00	29.00	28.50	79.60	29.50
MoleFlow [kgmole/h]	167.87	832.13	167.87	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	3.37	16.71	3.37	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	110.55	709.45	110.55	819.71	0.00	819.71	819.71	0.2862
ETHANE [kgmole/h]	22.73	74.27	22.73	16.05	0.00	16.05	16.05	80.95
PROPANE [kgmole/h]	14.58	30.42	14.58	0.00	0.00	0.00	0.00	45.00
n-BUTANE [kgmole/h]	2.16	2.84	2.16	0.00	0.00	0.00	0.00	5.00
n-PENTANE [kgmole/h]	9.69	8.31	9.69	0.00	0.00	0.00	0.00	18.00
ISOBUTANE [kgmole/h]	2.02	2.98	2.02	0.00	0.00	0.00	0.00	5.00
ISOPENTANE [kgmole/h]	2.54	2.36	2.54	0.00	0.00	0.00	0.00	4.90
C6+ [kgmole/h]	3.60	1.50	3.60	0.00	0.00	0.00	0.00	5.10

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	0.86	0.86	0.86	1.00
T [C]	40.00	40.00	40.00	-15.00	-15.00	-15.00	-15.00
P [bar]	100.00	100.00	100.00	99.50	99.50	99.50	99.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	863.40
StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	17.34
METHANE [kgmole/h]	820.00	574.00	246.00	574.00	246.00	820.00	735.32

ETHANE [kgmole/h]	97.00	67.90	29.10	67.90	29.10	97.00	77.79
PROPANE [kgmole/h]	45.00	31.50	13.50	31.50	13.50	45.00	31.91
n-BUTANE [kgmole/h]	5.00	3.50	1.50	3.50	1.50	5.00	2.95
n-PENTANE [kgmole/h]	18.00	12.60	5.40	12.60	5.40	18.00	8.47
ISOBUTANE [kgmole/h]	5.00	3.50	1.50	3.50	1.50	5.00	3.10
ISOPENTANE [kgmole/h]	4.90	3.43	1.47	3.43	1.47	4.90	2.42
C6+ [kgmole/h]	5.10	3.57	1.53	3.57	1.53	5.10	1.44

Name	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**Sales Gas**	**NGL Product**
Vapor Fraction	0.00	0.81	0.54	1.00	0.00	1.00	1.00	0.00
T [C]	-15.00	-67.10	-43.70	-90.00	-90.00	-5.90	28.90	45.50
P [bar]	99.50	30.00	30.00	29.00	29.00	28.50	79.60	29.50
MoleFlow [kgmole/h]	136.60	863.40	136.60	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	2.74	17.34	2.74	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	84.68	735.32	84.68	819.73	0.00	819.73	819.73	0.2741
ETHANE [kgmole/h]	19.21	77.79	19.21	16.04	0.00	16.04	16.04	80.96
PROPANE [kgmole/h]	13.09	31.91	13.09	0.00	0.00	0.00	0.00	45.00
n-BUTANE [kgmole/h]	2.05	2.95	2.05	0.00	0.00	0.00	0.00	5.00
n-PENTANE [kgmole/h]	9.53	8.47	9.53	0.00	0.00	0.00	0.00	18.00
ISOBUTANE [kgmole/h]	1.90	3.10	1.90	0.00	0.00	0.00	0.00	5.00
ISOPENTANE [kgmole/h]	2.48	2.42	2.48	0.00	0.00	0.00	0.00	4.90
C6+ [kgmole/h]	3.66	1.44	3.66	0.00	0.00	0.00	0.00	5.10

Name	**Feed Gas**	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**
Vapor Fraction	0.98	0.98	0.98	0.79	0.79	0.79	1.00
T [C]	25.00	25.00	25.00	-30.00	-30.00	-30.00	-30.00
P [bar]	70.00	70.00	70.00	69.50	69.50	69.50	69.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	793.90
StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	15.94
METHANE [kgmole/h]	820.00	574.00	246.00	574.00	246.00	820.00	709.95
ETHANE [kgmole/h]	97.00	67.90	29.10	67.90	29.10	97.00	60.91
PROPANE [kgmole/h]	45.00	31.50	13.50	31.50	13.50	45.00	18.20
n-BUTANE [kgmole/h]	5.00	3.50	1.50	3.50	1.50	5.00	1.06
n-PENTANE [kgmole/h]	18.00	12.60	5.40	12.60	5.40	18.00	1.84
ISOBUTANE [kgmole/h]	5.00	3.50	1.50	3.50	1.50	5.00	1.25
ISOPENTANE [kgmole/h]	4.90	3.43	1.47	3.43	1.47	4.90	0.57
C6+ [kgmole/h]	5.10	3.57	1.53	3.57	1.53	5.10	0.13

Name	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**Sales Gas**	**NGL Product**
Vapor Fraction	0.00	0.90	0.36	1.00	0.00	1.00	1.00	0.00
T [C]	-30.00	-68.20	-49.70	-90.00	-	-5.90	28.90	45.40

					90.00			
P [bar]	69.50	30.00	30.00	29.00	29.00	28.50	79.60	29.50
MoleFlow [kgmole/h]	206.10	793.90	206.10	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	4.14	15.94	4.14	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	110.05	709.95	110.05	819.71	0.00	819.71	819.71	0.2899
ETHANE [kgmole/h]	36.09	60.91	36.09	16.06	0.00	16.06	16.06	80.94
PROPANE [kgmole/h]	26.80	18.20	26.80	0.00	0.00	0.00	0.00	45.00
n-BUTANE [kgmole/h]	3.94	1.06	3.94	0.00	0.00	0.00	0.00	5.00
n-PENTANE [kgmole/h]	16.16	1.84	16.16	0.00	0.00	0.00	0.00	18.00
ISOBUTANE [kgmole/h]	3.75	1.25	3.75	0.00	0.00	0.00	0.00	5.00
ISOPENTANE [kgmole/h]	4.33	0.57	4.33	0.00	0.00	0.00	0.00	4.90
C6+ [kgmole/h]	4.97	0.13	4.97	0.00	0.00	0.00	0.00	5.10

Name	**Feed Gas**	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**
Vapor Fraction	0.99	0.99	0.99	0.85	0.85	0.85	1.00
T [C]	35.00	35.00	35.00	-20.00	-20.00	-20.00	-20.00
P [bar]	70.00	70.00	70.00	69.50	69.50	69.50	69.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	854.66
StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	17.16
METHANE [kgmole/h]	820.00	574.00	246.00	574.00	246.00	820.00	751.82
ETHANE [kgmole/h]	97.00	67.90	29.10	67.90	29.10	97.00	71.76
PROPANE [kgmole/h]	45.00	31.50	13.50	31.50	13.50	45.00	23.92
n-BUTANE [kgmole/h]	5.00	3.50	1.50	3.50	1.50	5.00	1.53
n-PENTANE [kgmole/h]	18.00	12.60	5.40	12.60	5.40	18.00	2.79
ISOBUTANE [kgmole/h]	5.00	3.50	1.50	3.50	1.50	5.00	1.77
ISOPENTANE [kgmole/h]	4.90	3.43	1.47	3.43	1.47	4.90	0.87
C6+ [kgmole/h]	5.10	3.57	1.53	3.57	1.53	5.10	0.20

Name	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**Sales Gas**	**NGL Product**
Vapor Fraction	0.00	0.92	0.34	1.00	0.00	1.00	1.00	0.00
T [C]	-20.00	-59.30	-37.10	-90.00	-90.00	-10.90	24.50	45.50
P [bar]	69.50	30.00	30.00	29.00	29.00	28.50	79.60	29.50
MoleFlow [kgmole/h]	145.34	854.66	145.34	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	2.92	17.16	2.92	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	68.18	751.82	68.18	819.73	0.00	819.73	819.73	0.2704
ETHANE [kgmole/h]	25.24	71.76	25.24	16.04	0.00	16.04	16.04	80.96
PROPANE [kgmole/h]	21.08	23.92	21.08	0.00	0.00	0.00	0.00	45.00
n-BUTANE [kgmole/h]	3.47	1.53	3.47	0.00	0.00	0.00	0.00	5.00
n-PENTANE [kgmole/h]	15.21	2.79	15.21	0.00	0.00	0.00	0.00	18.00
ISOBUTANE [kgmole/h]	3.23	1.77	3.23	0.00	0.00	0.00	0.00	5.00
ISOPENTANE [kgmole/h]	4.03	0.87	4.03	0.00	0.00	0.00	0.00	4.90

C6+ [kgmole/h]	4.90	0.20	4.90	0.00	0.00	0.00	0.00	5.10

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	0.88	0.88	0.88	1.00
T [C]	40.00	40.00	40.00	-15.00	-15.00	-15.00	-15.00
P [bar]	70.00	70.00	70.00	69.50	69.50	69.50	69.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	877.22
StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	17.61
METHANE [kgmole/h]	820.00	574.00	246.00	574.00	246.00	820.00	765.71
ETHANE [kgmole/h]	97.00	67.90	29.10	67.90	29.10	97.00	76.14
PROPANE [kgmole/h]	45.00	31.50	13.50	31.50	13.50	45.00	26.73
n-BUTANE [kgmole/h]	5.00	3.50	1.50	3.50	1.50	5.00	1.81
n-PENTANE [kgmole/h]	18.00	12.60	5.40	12.60	5.40	18.00	3.44
ISOBUTANE [kgmole/h]	5.00	3.50	1.50	3.50	1.50	5.00	2.07
ISOPENTANE [kgmole/h]	4.90	3.43	1.47	3.43	1.47	4.90	1.06
C6+ [kgmole/h]	5.10	3.57	1.53	3.57	1.53	5.10	0.26

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.92	0.32	1.00	0.00	1.00	1.00	0.00
T [C]	-15.00	-54.90	-30.90	-90.00	-90.00	-12.70	22.80	45.50
P [bar]	69.50	30.00	30.00	29.00	29.00	28.50	79.60	29.50
MoleFlow [kgmole/h]	122.78	877.22	122.78	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	2.47	17.61	2.47	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	54.29	765.71	54.29	819.74	0.00	819.74	819.74	0.2643
ETHANE [kgmole/h]	20.86	76.14	20.86	16.03	0.00	16.03	16.03	80.97
PROPANE [kgmole/h]	18.27	26.73	18.27	0.00	0.00	0.00	0.00	45.00
n-BUTANE [kgmole/h]	3.19	1.81	3.19	0.00	0.00	0.00	0.00	5.00
n-PENTANE [kgmole/h]	14.56	3.44	14.56	0.00	0.00	0.00	0.00	18.00
ISOBUTANE [kgmole/h]	2.93	2.07	2.93	0.00	0.00	0.00	0.00	5.00
ISOPENTANE [kgmole/h]	3.84	1.06	3.84	0.00	0.00	0.00	0.00	4.90
C6+ [kgmole/h]	4.84	0.26	4.84	0.00	0.00	0.00	0.00	5.10

30% PRESSURE DROP

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	0.99	0.99	0.99	0.82	0.82	0.82	1.00
T [C]	25.00	25.00	25.00	-30.00	-30.00	-30.00	-30.00
P [bar]	100.00	100.00	100.00	99.50	99.50	99.50	99.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	816.29

StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	16.39
METHANE [kgmole/h]	820.00	574.00	246.00	574.00	246.00	820.00	678.64
ETHANE [kgmole/h]	97.00	67.90	29.10	67.90	29.10	97.00	76.64
PROPANE [kgmole/h]	45.00	31.50	13.50	31.50	13.50	45.00	34.30
n-BUTANE [kgmole/h]	5.00	3.50	1.50	3.50	1.50	5.00	3.66
n-PENTANE [kgmole/h]	18.00	12.60	5.40	12.60	5.40	18.00	12.61
ISOBUTANE [kgmole/h]	5.00	3.50	1.50	3.50	1.50	5.00	3.70
ISOPENTANE [kgmole/h]	4.90	3.43	1.47	3.43	1.47	4.90	3.46
C6+ [kgmole/h]	5.10	3.57	1.53	3.57	1.53	5.10	3.28

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.66	0.65	1.00	0.00	1.00	1.00	0.00
T [C]	-30.00	-76.80	-66.40	-90.00	-90.00	7.40	35.90	45.40
P [bar]	99.50	30.00	30.00	29.00	29.00	28.50	69.65	29.50
MoleFlow [kgmole/h]	183.71	816.29	183.71	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	3.69	16.39	3.69	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	141.36	678.64	141.36	819.70	0.00	819.70	819.70	0.30
ETHANE [kgmole/h]	20.36	76.64	20.36	16.06	0.00	16.06	16.06	80.94
PROPANE [kgmole/h]	10.70	34.30	10.70	0.00	0.00	0.00	0.00	45.00
n-BUTANE [kgmole/h]	1.34	3.66	1.34	0.00	0.00	0.00	0.00	5.00
n-PENTANE [kgmole/h]	5.39	12.61	5.39	0.00	0.00	0.00	0.00	18.00
ISOBUTANE [kgmole/h]	1.30	3.70	1.30	0.00	0.00	0.00	0.00	5.00
ISOPENTANE [kgmole/h]	1.44	3.46	1.44	0.00	0.00	0.00	0.00	4.90
C6+ [kgmole/h]	1.82	3.28	1.82	0.00	0.00	0.00	0.00	5.10

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	0.83	0.83	0.83	1.00
T [C]	35.00	35.00	35.00	-20.00	-20.00	-20.00	-20.00
P [bar]	100.00	100.00	100.00	99.50	99.50	99.50	99.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	832.13
StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	16.71
METHANE [kgmole/h]	820.00	574.00	246.00	574.00	246.00	820.00	709.45
ETHANE [kgmole/h]	97.00	67.90	29.10	67.90	29.10	97.00	74.27
PROPANE [kgmole/h]	45.00	31.50	13.50	31.50	13.50	45.00	30.42
n-BUTANE [kgmole/h]	5.00	3.50	1.50	3.50	1.50	5.00	2.84
n-PENTANE [kgmole/h]	18.00	12.60	5.40	12.60	5.40	18.00	8.31
ISOBUTANE [kgmole/h]	5.00	3.50	1.50	3.50	1.50	5.00	2.98
ISOPENTANE [kgmole/h]	4.90	3.43	1.47	3.43	1.47	4.90	2.36
C6+ [kgmole/h]	5.10	3.57	1.53	3.57	1.53	5.10	1.50

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.78	0.56	1.00	0.00	1.00	1.00	0.00
T [C]	-20.00	-70.90	-50.80	-90.00	-90.00	-2.00	27.20	45.40
P [bar]	99.50	30.00	30.00	29.00	29.00	28.50	69.65	29.50
MoleFlow [kgmole/h]	167.87	832.13	167.87	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	3.37	16.71	3.37	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	110.55	709.45	110.55	819.71	0.00	819.71	819.71	0.29
ETHANE [kgmole/h]	22.73	74.27	22.73	16.05	0.00	16.05	16.05	80.95
PROPANE [kgmole/h]	14.58	30.42	14.58	0.00	0.00	0.00	0.00	45.00
n-BUTANE [kgmole/h]	2.16	2.84	2.16	0.00	0.00	0.00	0.00	5.00
n-PENTANE [kgmole/h]	9.69	8.31	9.69	0.00	0.00	0.00	0.00	18.00
ISOBUTANE [kgmole/h]	2.02	2.98	2.02	0.00	0.00	0.00	0.00	5.00
ISOPENTANE [kgmole/h]	2.54	2.36	2.54	0.00	0.00	0.00	0.00	4.90
C6+ [kgmole/h]	3.60	1.50	3.60	0.00	0.00	0.00	0.00	5.10

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	0.86	0.86	0.86	1.00
T [C]	40.00	40.00	40.00	-15.00	-15.00	-15.00	-15.00
P [bar]	100.00	100.00	100.00	99.50	99.50	99.50	99.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	863.40
StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	17.34
METHANE [kgmole/h]	820.00	574.00	246.00	574.00	246.00	820.00	735.32
ETHANE [kgmole/h]	97.00	67.90	29.10	67.90	29.10	97.00	77.79
PROPANE [kgmole/h]	45.00	31.50	13.50	31.50	13.50	45.00	31.91
n-BUTANE [kgmole/h]	5.00	3.50	1.50	3.50	1.50	5.00	2.95
n-PENTANE [kgmole/h]	18.00	12.60	5.40	12.60	5.40	18.00	8.47
ISOBUTANE [kgmole/h]	5.00	3.50	1.50	3.50	1.50	5.00	3.10
ISOPENTANE [kgmole/h]	4.90	3.43	1.47	3.43	1.47	4.90	2.42
C6+ [kgmole/h]	5.10	3.57	1.53	3.57	1.53	5.10	1.44

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.81	0.54	1.00	0.00	1.00	1.00	0.00
T [C]	-15.00	-67.10	-43.70	-90.00	-90.00	-5.90	23.60	45.50
P [bar]	99.50	30.00	30.00	29.00	29.00	28.50	69.65	29.50
MoleFlow [kgmole/h]	136.60	863.40	136.60	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow	2.74	17.34	2.74	16.78	0.00	16.78	16.78	3.30

[MMSCFD]								
METHANE [kgmole/h]	84.68	735.32	84.68	819.73	0.00	819.73	819.73	0.27
ETHANE [kgmole/h]	19.21	77.79	19.21	16.04	0.00	16.04	16.04	80.96
PROPANE [kgmole/h]	13.09	31.91	13.09	0.00	0.00	0.00	0.00	45.00
n-BUTANE [kgmole/h]	2.05	2.95	2.05	0.00	0.00	0.00	0.00	5.00
n-PENTANE [kgmole/h]	9.53	8.47	9.53	0.00	0.00	0.00	0.00	18.00
ISOBUTANE [kgmole/h]	1.90	3.10	1.90	0.00	0.00	0.00	0.00	5.00
ISOPENTANE [kgmole/h]	2.48	2.42	2.48	0.00	0.00	0.00	0.00	4.90
C6+ [kgmole/h]	3.66	1.44	3.66	0.00	0.00	0.00	0.00	5.10

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	0.98	0.98	0.98	0.79	0.79	0.79	1.00
T [C]	25.00	25.00	25.00	-30.00	-30.00	-30.00	-30.00
P [bar]	70.00	70.00	70.00	69.50	69.50	69.50	69.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	793.90
StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	15.94
METHANE [kgmole/h]	820.00	574.00	246.00	574.00	246.00	820.00	709.95
ETHANE [kgmole/h]	97.00	67.90	29.10	67.90	29.10	97.00	60.91
PROPANE [kgmole/h]	45.00	31.50	13.50	31.50	13.50	45.00	18.20
n-BUTANE [kgmole/h]	5.00	3.50	1.50	3.50	1.50	5.00	1.06
n-PENTANE [kgmole/h]	18.00	12.60	5.40	12.60	5.40	18.00	1.84
ISOBUTANE [kgmole/h]	5.00	3.50	1.50	3.50	1.50	5.00	1.25
ISOPENTANE [kgmole/h]	4.90	3.43	1.47	3.43	1.47	4.90	0.57
C6+ [kgmole/h]	5.10	3.57	1.53	3.57	1.53	5.10	0.13

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.90	0.36	1.00	0.00	1.00	1.00	0.00
T [C]	-30.00	-68.20	-49.70	-90.00	-90.00	-5.90	23.60	45.40
P [bar]	69.50	30.00	30.00	29.00	29.00	28.50	69.65	29.50
MoleFlow [kgmole/h]	206.10	793.90	206.10	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	4.14	15.94	4.14	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	110.05	709.95	110.05	819.71	0.00	819.71	819.71	0.29
ETHANE [kgmole/h]	36.09	60.91	36.09	16.06	0.00	16.06	16.06	80.94
PROPANE [kgmole/h]	26.80	18.20	26.80	0.00	0.00	0.00	0.00	45.00
n-BUTANE [kgmole/h]	3.94	1.06	3.94	0.00	0.00	0.00	0.00	5.00
n-PENTANE [kgmole/h]	16.16	1.84	16.16	0.00	0.00	0.00	0.00	18.00
ISOBUTANE [kgmole/h]	3.75	1.25	3.75	0.00	0.00	0.00	0.00	5.00
ISOPENTANE [kgmole/h]	4.33	0.57	4.33	0.00	0.00	0.00	0.00	4.90
C6+ [kgmole/h]	4.97	0.13	4.97	0.00	0.00	0.00	0.00	5.10

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	0.99	0.99	0.99	0.85	0.85	0.85	1.00
T [C]	35.00	35.00	35.00	-20.00	-20.00	-20.00	-20.00
P [bar]	70.00	70.00	70.00	69.50	69.50	69.50	69.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	854.66
StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	17.16
METHANE [kgmole/h]	820.00	574.00	246.00	574.00	246.00	820.00	751.82
ETHANE [kgmole/h]	97.00	67.90	29.10	67.90	29.10	97.00	71.76
PROPANE [kgmole/h]	45.00	31.50	13.50	31.50	13.50	45.00	23.92
n-BUTANE [kgmole/h]	5.00	3.50	1.50	3.50	1.50	5.00	1.53
n-PENTANE [kgmole/h]	18.00	12.60	5.40	12.60	5.40	18.00	2.79
ISOBUTANE [kgmole/h]	5.00	3.50	1.50	3.50	1.50	5.00	1.77
ISOPENTANE [kgmole/h]	4.90	3.43	1.47	3.43	1.47	4.90	0.87
C6+ [kgmole/h]	5.10	3.57	1.53	3.57	1.53	5.10	0.20

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.92	0.34	1.00	0.00	1.00	1.00	0.00
T [C]	-20.00	-59.30	-37.10	-90.00	-90.00	-10.90	19.10	45.50
P [bar]	69.50	30.00	30.00	29.00	29.00	28.50	69.65	29.50
MoleFlow [kgmole/h]	145.34	854.66	145.34	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	2.92	17.16	2.92	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	68.18	751.82	68.18	819.73	0.00	819.73	819.73	0.27
ETHANE [kgmole/h]	25.24	71.76	25.24	16.04	0.00	16.04	16.04	80.96
PROPANE [kgmole/h]	21.08	23.92	21.08	0.00	0.00	0.00	0.00	45.00
n-BUTANE [kgmole/h]	3.47	1.53	3.47	0.00	0.00	0.00	0.00	5.00
n-PENTANE [kgmole/h]	15.21	2.79	15.21	0.00	0.00	0.00	0.00	18.00
ISOBUTANE [kgmole/h]	3.23	1.77	3.23	0.00	0.00	0.00	0.00	5.00
ISOPENTANE [kgmole/h]	4.03	0.87	4.03	0.00	0.00	0.00	0.00	4.90
C6+ [kgmole/h]	4.90	0.20	4.90	0.00	0.00	0.00	0.00	5.10

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	0.88	0.88	0.88	1.00
T [C]	40.00	40.00	40.00	-15.00	-15.00	-15.00	-15.00
P [bar]	70.00	70.00	70.00	69.50	69.50	69.50	69.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	877.22
StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	17.61
METHANE [kgmole/h]	820.00	574.00	246.00	574.00	246.00	820.00	765.71
ETHANE [kgmole/h]	97.00	67.90	29.10	67.90	29.10	97.00	76.14
PROPANE [kgmole/h]	45.00	31.50	13.50	31.50	13.50	45.00	26.73

n-BUTANE [kgmole/h]	5.00	3.50	1.50	3.50	1.50	5.00	1.81
n-PENTANE [kgmole/h]	18.00	12.60	5.40	12.60	5.40	18.00	3.44
ISOBUTANE [kgmole/h]	5.00	3.50	1.50	3.50	1.50	5.00	2.07
ISOPENTANE [kgmole/h]	4.90	3.43	1.47	3.43	1.47	4.90	1.06
C6+ [kgmole/h]	5.10	3.57	1.53	3.57	1.53	5.10	0.26

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.92	0.32	1.00	0.00	1.00	1.00	0.00
T [C]	-15.00	-54.90	-30.90	-90.00	-90.00	-12.70	17.40	45.50
P [bar]	69.50	30.00	30.00	29.00	29.00	28.50	69.65	29.50
MoleFlow [kgmole/h]	122.78	877.22	122.78	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	2.47	17.61	2.47	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	54.29	765.71	54.29	819.74	0.00	819.74	819.74	0.26
ETHANE [kgmole/h]	20.86	76.14	20.86	16.03	0.00	16.03	16.03	80.97
PROPANE [kgmole/h]	18.27	26.73	18.27	0.00	0.00	0.00	0.00	45.00
n-BUTANE [kgmole/h]	3.19	1.81	3.19	0.00	0.00	0.00	0.00	5.00
n-PENTANE [kgmole/h]	14.56	3.44	14.56	0.00	0.00	0.00	0.00	18.00
ISOBUTANE [kgmole/h]	2.93	2.07	2.93	0.00	0.00	0.00	0.00	5.00
ISOPENTANE [kgmole/h]	3.84	1.06	3.84	0.00	0.00	0.00	0.00	4.90
C6+ [kgmole/h]	4.84	0.26	4.84	0.00	0.00	0.00	0.00	5.10

APPENDIX B

FULL TABULATION OF SIMULATION RESULTS FOR TURBO EXPANDER SYSTEM – NORMAL FEED STREAM

20% PRESSURE DROP

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	1.00	1.00	1.00	1.00
T [C]	25.00	25.00	25.00	-30.00	-30.00	-30.00	-30.00
P [bar]	100.00	100.00	100.00	99.50	99.50	99.50	99.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	1000.00
StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	20.08
METHANE [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	870.00
ETHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	79.00
PROPANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	33.00
n-BUTANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	4.60
n-PENTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.72	0.82	1.00	0.00	1.00	1.00	0.00
T [C]	-30.00	-78.70	-70.30	-97.10	-97.10	-18.10	17.60	-26.40
P [bar]	99.50	30.00	30.00	29.00	29.00	28.50	79.60	29.50
MoleFlow [kgmole/h]	0.00	1000.00	0.00	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	0.00	20.08	0.00	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	0.00	870.00	0.00	835.72	0.00	835.72	835.72	34.28
ETHANE [kgmole/h]	0.00	79.00	0.00	0.05	0.00	0.05	0.05	78.95
PROPANE [kgmole/h]	0.00	33.00	0.00	0.00	0.00	0.00	0.00	33.00
n-BUTANE [kgmole/h]	0.00	4.60	0.00	0.00	0.00	0.00	0.00	4.60
n-PENTANE [kgmole/h]	0.00	11.30	0.00	0.00	0.00	0.00	0.00	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	0.00	2.10	0.00	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	1.00	1.00	1.00	1.00
T [C]	35.00	35.00	35.00	-20.00	-20.00	-20.00	-20.00
P [bar]	100.00	100.00	100.00	99.50	99.50	99.50	99.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	1000.00
StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	20.08
METHANE [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	870.00
ETHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	79.00
PROPANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	33.00
n-BUTANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	4.60
n-PENTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.80	0.88	1.00	0.00	1.00	1.00	0.00
T [C]	-20.00	-72.20	-59.30	-97.10	-97.10	-26.90	9.70	-26.50
P [bar]	99.50	30.00	30.00	29.00	29.00	28.50	79.60	29.50
MoleFlow [kgmole/h]	0.00	1000.00	0.00	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	0.00	20.08	0.00	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	0.00	870.00	0.00	835.71	0.00	835.71	835.71	34.29
ETHANE [kgmole/h]	0.00	79.00	0.00	0.06	0.00	0.06	0.06	78.94
PROPANE [kgmole/h]	0.00	33.00	0.00	0.00	0.00	0.00	0.00	33.00
n-BUTANE [kgmole/h]	0.00	4.60	0.00	0.00	0.00	0.00	0.00	4.60
n-PENTANE [kgmole/h]	0.00	11.30	0.00	0.00	0.00	0.00	0.00	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	0.00	2.10	0.00	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	1.00	1.00	1.00	1.00
T [C]	40.00	40.00	40.00	-15.00	-15.00	-15.00	-15.00
P [bar]	100.00	100.00	100.00	99.50	99.50	99.50	99.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	1000.00
StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	20.08
METHANE [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	870.00
ETHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	79.00

PROPANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	33.00
n-BUTANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	4.60
n-PENTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.83	0.91	1.00	0.00	1.00	1.00	0.00
T [C]	-15.00	-68.70	-53.60	-97.10	-97.10	-30.50	6.50	-26.50
P [bar]	99.50	30.00	30.00	29.00	29.00	28.50	79.60	29.50
MoleFlow [kgmole/h]	0.00	1000.00	0.00	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	0.00	20.08	0.00	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	0.00	870.00	0.00	835.71	0.00	835.71	835.71	34.29
ETHANE [kgmole/h]	0.00	79.00	0.00	0.06	0.00	0.06	0.06	78.94
PROPANE [kgmole/h]	0.00	33.00	0.00	0.00	0.00	0.00	0.00	33.00
n-BUTANE [kgmole/h]	0.00	4.60	0.00	0.00	0.00	0.00	0.00	4.60
n-PENTANE [kgmole/h]	0.00	11.30	0.00	0.00	0.00	0.00	0.00	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	0.00	2.10	0.00	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	0.92	0.92	0.92	1.00
T [C]	25.00	25.00	25.00	-30.00	-30.00	-30.00	-30.00
P [bar]	70.00	70.00	70.00	69.50	69.50	69.50	69.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	921.16
StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	18.50
METHANE [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	827.06
ETHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	66.10
PROPANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	22.37
n-BUTANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	2.09
n-PENTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	2.95
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	0.60
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.90	0.37	1.00	0.00	1.00	1.00	0.00
T [C]	-30.00	-68.30	-50.10	-97.10	-97.10	-30.80	6.20	-26.50

P [bar]	69.50	30.00	30.00	29.00	29.00	28.50	79.60	29.50
MoleFlow [kgmole/h]	78.84	921.16	78.84	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	1.58	18.50	1.58	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	42.94	827.06	42.94	835.71	0.00	835.71	835.71	34.29
ETHANE [kgmole/h]	12.90	66.10	12.90	0.06	0.00	0.06	0.06	78.94
PROPANE [kgmole/h]	10.63	22.37	10.63	0.00	0.00	0.00	0.00	33.00
n-BUTANE [kgmole/h]	2.51	2.09	2.51	0.00	0.00	0.00	0.00	4.60
n-PENTANE [kgmole/h]	8.35	2.95	8.35	0.00	0.00	0.00	0.00	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	1.50	0.60	1.50	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	0.96	0.96	0.96	1.00
T [C]	35.00	35.00	35.00	-20.00	-20.00	-20.00	-20.00
P [bar]	70.00	70.00	70.00	69.50	69.50	69.50	69.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	956.45
StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	19.20
METHANE [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	849.20
ETHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	72.16
PROPANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	26.76
n-BUTANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	2.86
n-PENTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	4.55
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	0.92
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.92	0.34	1.00	0.00	1.00	1.00	0.00
T [C]	-20.00	-59.70	-37.20	-97.10	-97.10	-37.30	0.50	-26.50
P [bar]	69.50	30.00	30.00	29.00	29.00	28.50	79.60	29.50
MoleFlow [kgmole/h]	43.55	956.45	43.55	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	0.87	19.20	0.87	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	20.80	849.20	20.80	835.70	0.00	835.70	835.70	34.30
ETHANE [kgmole/h]	6.84	72.16	6.84	0.07	0.00	0.07	0.07	78.93
PROPANE [kgmole/h]	6.24	26.76	6.24	0.00	0.00	0.00	0.00	33.00
n-BUTANE [kgmole/h]	1.74	2.86	1.74	0.00	0.00	0.00	0.00	4.60
n-PENTANE [kgmole/h]	6.75	4.55	6.75	0.00	0.00	0.00	0.00	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	1.18	0.92	1.18	0.00	0.00	0.00	0.00	2.10

C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	0.97	0.97	0.97	1.00
T [C]	40.00	40.00	40.00	-15.00	-15.00	-15.00	-15.00
P [bar]	70.00	70.00	70.00	69.50	69.50	69.50	69.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	968.99
StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	19.46
METHANE [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	856.03
ETHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	74.31
PROPANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	28.58
n-BUTANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	3.28
n-PENTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	5.66
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	1.13
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.93	0.33	1.00	0.00	1.00	1.00	0.00
T [C]	-15.00	-55.40	-30.90	-97.10	-97.10	-40.00	-1.80	-26.50
P [bar]	69.50	30.00	30.00	29.00	29.00	28.50	79.60	29.50
MoleFlow [kgmole/h]	31.01	968.99	31.01	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	0.62	19.46	0.62	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	13.97	856.03	13.97	835.70	0.00	835.70	835.70	34.30
ETHANE [kgmole/h]	4.69	74.31	4.69	0.07	0.00	0.07	0.07	78.93
PROPANE [kgmole/h]	4.42	28.58	4.42	0.00	0.00	0.00	0.00	33.00
n-BUTANE [kgmole/h]	1.32	3.28	1.32	0.00	0.00	0.00	0.00	4.60
n-PENTANE [kgmole/h]	5.64	5.66	5.64	0.00	0.00	0.00	0.00	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	0.97	1.13	0.97	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

30% PRESSURE DROP

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.000	1.000	1.000	1.000	1.000	1.000	1.000
T [C]	25.000	25.000	25.000	-30.000	-30.000	-30.000	-30.000
P [bar]	100.000	100.000	100.000	99.500	99.500	99.500	99.500
MoleFlow [kgmole/h]	1000.000	700.000	300.000	700.000	300.000	1000.000	1000.000
StdGasVolumeFlow	20.079	14.055	6.024	14.055	6.024	20.079	20.079

[MMSCFD]							
METHANE [kgmole/h]	870.000	609.000	261.000	609.000	261.000	870.000	870.000
ETHANE [kgmole/h]	79.000	55.300	23.700	55.300	23.700	79.000	79.000
PROPANE [kgmole/h]	33.000	23.100	9.900	23.100	9.900	33.000	33.000
n-BUTANE [kgmole/h]	4.600	3.220	1.380	3.220	1.380	4.600	4.600
n-PENTANE [kgmole/h]	11.300	7.910	3.390	7.910	3.390	11.300	11.300
ISOBUTANE [kgmole/h]	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ISOPENTANE [kgmole/h]	2.100	1.470	0.630	1.470	0.630	2.100	2.100
C6+ [kgmole/h]	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.72	0.82	1.00	0.00	1.00	1.00	0.00
T [C]	-30.00	-78.70	-70.30	-97.10	-97.10	-18.10	12.10	-26.40
P [bar]	99.50	30.00	30.00	29.00	29.00	28.50	69.65	29.50
MoleFlow [kgmole/h]	0.00	1000.00	0.00	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	0.00	20.08	0.00	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	0.00	870.00	0.00	835.72	0.00	835.72	835.72	34.28
ETHANE [kgmole/h]	0.00	79.00	0.00	0.05	0.00	0.05	0.05	78.95
PROPANE [kgmole/h]	0.00	33.00	0.00	0.00	0.00	0.00	0.00	33.00
n-BUTANE [kgmole/h]	0.00	4.60	0.00	0.00	0.00	0.00	0.00	4.60
n-PENTANE [kgmole/h]	0.00	11.30	0.00	0.00	0.00	0.00	0.00	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	0.00	2.10	0.00	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.000	1.000	1.000	1.000	1.000	1.000	1.000
T [C]	35.000	35.000	35.000	-20.000	-20.000	-20.000	-20.000
P [bar]	100.000	100.000	100.000	99.500	99.500	99.500	99.500
MoleFlow [kgmole/h]	1000.000	700.000	300.000	700.000	300.000	1000.000	1000.000
StdGasVolumeFlow [MMSCFD]	20.079	14.055	6.024	14.055	6.024	20.079	20.079
METHANE [kgmole/h]	870.000	609.000	261.000	609.000	261.000	870.000	870.000
ETHANE [kgmole/h]	79.000	55.300	23.700	55.300	23.700	79.000	79.000
PROPANE [kgmole/h]	33.000	23.100	9.900	23.100	9.900	33.000	33.000
n-BUTANE [kgmole/h]	4.600	3.220	1.380	3.220	1.380	4.600	4.600
n-PENTANE [kgmole/h]	11.300	7.910	3.390	7.910	3.390	11.300	11.300
ISOBUTANE [kgmole/h]	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ISOPENTANE [kgmole/h]	2.100	1.470	0.630	1.470	0.630	2.100	2.100
C6+ [kgmole/h]	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.80	0.88	1.00	0.00	1.00	1.00	0.00
T [C]	-20.00	-72.20	-59.30	-97.10	-97.10	-26.90	4.10	-20.00
P [bar]	99.50	30.00	30.00	29.00	29.00	28.50	69.65	99.50
MoleFlow [kgmole/h]	0.00	1000.00	0.00	835.77	0.00	835.77	835.77	0.00
StdGasVolumeFlow [MMSCFD]	0.00	20.08	0.00	16.78	0.00	16.78	16.78	0.00
METHANE [kgmole/h]	0.000	870.000	0.000	835.710	0.000	835.710	835.710	0.000
ETHANE [kgmole/h]	0.000	79.000	0.000	0.056	0.000	0.056	0.056	0.000
PROPANE [kgmole/h]	0.000	33.000	0.000	0.000	0.000	0.000	0.000	0.000
n-BUTANE [kgmole/h]	0.000	4.600	0.000	0.000	0.000	0.000	0.000	0.000
n-PENTANE [kgmole/h]	0.000	11.300	0.000	0.000	0.000	0.000	0.000	0.000
ISOBUTANE [kgmole/h]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ISOPENTANE [kgmole/h]	0.000	2.100	0.000	0.000	0.000	0.000	0.000	0.000
C6+ [kgmole/h]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.000	1.000	1.000	1.000	1.000	1.000	1.000
T [C]	40.000	40.000	40.000	-15.000	-15.000	-15.000	-15.000
P [bar]	100.000	100.000	100.000	99.500	99.500	99.500	99.500
MoleFlow [kgmole/h]	1000.000	700.000	300.000	700.000	300.000	1000.000	1000.000
StdGasVolumeFlow [MMSCFD]	20.079	14.055	6.024	14.055	6.024	20.079	20.079
METHANE [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	870.00
ETHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	79.00
PROPANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	33.00
n-BUTANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	4.60
n-PENTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.83	0.91	1.00	0.00	1.00	1.00	0.00
T [C]	-15.00	-68.70	-53.60	-97.10	-97.10	-30.50	0.90	-26.50
P [bar]	99.50	30.00	30.00	29.00	29.00	28.50	69.65	29.50
MoleFlow [kgmole/h]	0.00	1000.00	0.00	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow	0.00	20.08	0.00	16.78	0.00	16.78	16.78	3.30

[MMSCFD]								
METHANE [kgmole/h]	0.00	870.00	0.00	835.71	0.00	835.71	835.71	34.29
ETHANE [kgmole/h]	0.00	79.00	0.00	0.06	0.00	0.06	0.06	78.94
PROPANE [kgmole/h]	0.00	33.00	0.00	0.00	0.00	0.00	0.00	33.00
n-BUTANE [kgmole/h]	0.00	4.60	0.00	0.00	0.00	0.00	0.00	4.60
n-PENTANE [kgmole/h]	0.00	11.30	0.00	0.00	0.00	0.00	0.00	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	0.00	2.10	0.00	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.000	1.000	1.000	0.921	0.921	0.921	1.000
T [C]	25.000	25.000	25.000	-30.000	-30.000	-30.000	-30.000
P [bar]	70.000	70.000	70.000	69.500	69.500	69.500	69.500
MoleFlow [kgmole/h]	1000.000	700.000	300.000	700.000	300.000	1000.000	921.160
StdGasVolumeFlow [MMSCFD]	20.079	14.055	6.024	14.055	6.024	20.079	18.496
METHANE [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	827.06
ETHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	66.10
PROPANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	22.37
n-BUTANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	2.09
n-PENTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	2.95
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	0.60
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.90	0.37	1.00	0.00	1.00	1.00	0.00
T [C]	-30.00	-68.30	-50.10	-97.10	-97.10	-30.80	0.60	-26.50
P [bar]	69.50	30.00	30.00	29.00	29.00	28.50	69.65	29.50
MoleFlow [kgmole/h]	78.84	921.16	78.84	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	1.58	18.50	1.58	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	42.94	827.06	42.94	835.71	0.00	835.71	835.71	34.29
ETHANE [kgmole/h]	12.90	66.10	12.90	0.06	0.00	0.06	0.06	78.94
PROPANE [kgmole/h]	10.63	22.37	10.63	0.00	0.00	0.00	0.00	33.00
n-BUTANE [kgmole/h]	2.51	2.09	2.51	0.00	0.00	0.00	0.00	4.60
n-PENTANE [kgmole/h]	8.35	2.95	8.35	0.00	0.00	0.00	0.00	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	1.50	0.60	1.50	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.000	1.000	1.000	0.956	0.956	0.956	1.000
T [C]	35.000	35.000	35.000	-20.000	-20.000	-20.000	-20.000
P [bar]	70.000	70.000	70.000	69.500	69.500	69.500	69.500
MoleFlow [kgmole/h]	1000.000	700.000	300.000	700.000	300.000	1000.000	956.450
StdGasVolumeFlow [MMSCFD]	20.079	14.055	6.024	14.055	6.024	20.079	19.204
METHANE [kgmole/h]	870.000	609.000	261.000	609.000	261.000	870.000	849.200
ETHANE [kgmole/h]	79.000	55.300	23.700	55.300	23.700	79.000	72.160
PROPANE [kgmole/h]	33.000	23.100	9.900	23.100	9.900	33.000	26.760
n-BUTANE [kgmole/h]	4.600	3.220	1.380	3.220	1.380	4.600	2.860
n-PENTANE [kgmole/h]	11.300	7.910	3.390	7.910	3.390	11.300	4.550
ISOBUTANE [kgmole/h]	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ISOPENTANE [kgmole/h]	2.100	1.470	0.630	1.470	0.630	2.100	0.922
C6+ [kgmole/h]	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.92	0.34	1.00	0.00	1.00	1.00	0.00
T [C]	-20.00	-59.70	-37.20	-97.10	-97.10	-37.30	-5.20	-26.50
P [bar]	69.50	30.00	30.00	29.00	29.00	28.50	69.65	29.50
MoleFlow [kgmole/h]	43.55	956.45	43.55	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	0.87	19.20	0.87	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	20.80	849.20	20.80	835.70	0.00	835.70	835.70	34.30
ETHANE [kgmole/h]	6.84	72.16	6.84	0.07	0.00	0.07	0.07	78.93
PROPANE [kgmole/h]	6.24	26.76	6.24	0.00	0.00	0.00	0.00	33.00
n-BUTANE [kgmole/h]	1.74	2.86	1.74	0.00	0.00	0.00	0.00	4.60
n-PENTANE [kgmole/h]	6.75	4.55	6.75	0.00	0.00	0.00	0.00	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	1.18	0.92	1.18	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.000	1.000	1.000	0.969	0.969	0.969	1.000
T [C]	40.000	40.000	40.000	-15.000	-15.000	-15.000	-15.000
P [bar]	70.000	70.000	70.000	69.500	69.500	69.500	69.500
MoleFlow [kgmole/h]	1000.000	700.000	300.000	700.000	300.000	1000.000	968.990
StdGasVolumeFlow	870.00	609.00	261.00	609.00	261.00	870.00	856.03

[MMSCFD]							
METHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	74.31
ETHANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	28.58
PROPANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	3.28
n-BUTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	5.66
n-PENTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOBUTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	1.13
ISOPENTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C6+ [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	856.03

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.93	0.33	1.00	0.00	1.00	1.00	0.00
T [C]	-15.00	-55.40	-30.90	-97.10	-97.10	-40.00	-7.50	-26.50
P [bar]	69.50	30.00	30.00	29.00	29.00	28.50	69.65	29.50
MoleFlow [kgmole/h]	31.01	968.99	31.01	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	0.62	19.46	0.62	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	13.97	856.03	13.97	835.70	0.00	835.70	835.70	34.30
ETHANE [kgmole/h]	4.69	74.31	4.69	0.07	0.00	0.07	0.07	78.93
PROPANE [kgmole/h]	4.42	28.58	4.42	0.00	0.00	0.00	0.00	33.00
n-BUTANE [kgmole/h]	1.32	3.28	1.32	0.00	0.00	0.00	0.00	4.60
n-PENTANE [kgmole/h]	5.64	5.66	5.64	0.00	0.00	0.00	0.00	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	0.97	1.13	0.97	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

APPENDIX C

FULL TABULATION OF SIMULATION RESULTS FOR TURBO EXPANDER SYSTEM –LEAN FEED STREAM

20% PRESSURE DROP

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	1.00	1.00	1.00	1.00
T [C]	25.00	25.00	25.00	-30.00	-30.00	-30.00	-30.00
P [bar]	100.00	100.00	100.00	99.50	99.50	99.50	99.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	1000.00
StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	20.08
METHANE [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	870.00
ETHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	79.00
PROPANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	33.00
n-BUTANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	4.60
n-PENTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.72	0.82	1.00	0.00	1.00	1.00	0.00
T [C]	-30.00	-78.70	-70.30	-97.10	-97.10	-18.10	17.60	-26.40
P [bar]	99.50	30.00	30.00	29.00	29.00	28.50	79.60	29.50
MoleFlow [kgmole/h]	0.00	1000.00	0.00	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	0.00	20.08	0.00	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	0.00	870.00	0.00	835.72	0.00	835.72	835.72	34.28
ETHANE [kgmole/h]	0.00	79.00	0.00	0.05	0.00	0.05	0.05	78.95
PROPANE [kgmole/h]	0.00	33.00	0.00	0.00	0.00	0.00	0.00	33.00
n-BUTANE [kgmole/h]	0.00	4.60	0.00	0.00	0.00	0.00	0.00	4.60
n-PENTANE [kgmole/h]	0.00	11.30	0.00	0.00	0.00	0.00	0.00	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	0.00	2.10	0.00	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	1.00	1.00	1.00	1.00
T [C]	35.00	35.00	35.00	-20.00	-20.00	-20.00	-20.00
P [bar]	100.00	100.00	100.00	99.50	99.50	99.50	99.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	1000.00
StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	20.08
METHANE [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	870.00
ETHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	79.00
PROPANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	33.00
n-BUTANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	4.60
n-PENTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.80	0.88	1.00	0.00	1.00	1.00	0.00
T [C]	-20.00	-72.20	-59.30	-97.10	-97.10	-26.90	9.70	-26.50
P [bar]	99.50	30.00	30.00	29.00	29.00	28.50	79.60	29.50
MoleFlow [kgmole/h]	0.00	1000.00	0.00	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	0.00	20.08	0.00	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	0.00	870.00	0.00	835.71	0.00	835.71	835.71	34.29
ETHANE [kgmole/h]	0.00	79.00	0.00	0.06	0.00	0.06	0.06	78.94
PROPANE [kgmole/h]	0.00	33.00	0.00	0.00	0.00	0.00	0.00	33.00
n-BUTANE [kgmole/h]	0.00	4.60	0.00	0.00	0.00	0.00	0.00	4.60
n-PENTANE [kgmole/h]	0.00	11.30	0.00	0.00	0.00	0.00	0.00	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	0.00	2.10	0.00	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	1.00	1.00	1.00	1.00
T [C]	40.00	40.00	40.00	-15.00	-15.00	-15.00	-15.00
P [bar]	100.00	100.00	100.00	99.50	99.50	99.50	99.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	1000.00
StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	20.08
METHANE [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	870.00
ETHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	79.00

PROPANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	33.00
n-BUTANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	4.60
n-PENTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.83	0.91	1.00	0.00	1.00	1.00	0.00
T [C]	-15.00	-68.70	-53.60	-97.10	-97.10	-30.50	6.50	-26.50
P [bar]	99.50	30.00	30.00	29.00	29.00	28.50	79.60	29.50
MoleFlow [kgmole/h]	0.00	1000.00	0.00	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	0.00	20.08	0.00	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	0.00	870.00	0.00	835.71	0.00	835.71	835.71	34.29
ETHANE [kgmole/h]	0.00	79.00	0.00	0.06	0.00	0.06	0.06	78.94
PROPANE [kgmole/h]	0.00	33.00	0.00	0.00	0.00	0.00	0.00	33.00
n-BUTANE [kgmole/h]	0.00	4.60	0.00	0.00	0.00	0.00	0.00	4.60
n-PENTANE [kgmole/h]	0.00	11.30	0.00	0.00	0.00	0.00	0.00	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	0.00	2.10	0.00	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	0.92	0.92	0.92	1.00
T [C]	25.00	25.00	25.00	-30.00	-30.00	-30.00	-30.00
P [bar]	70.00	70.00	70.00	69.50	69.50	69.50	69.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	921.16
StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	18.50
METHANE [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	827.06
ETHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	66.10
PROPANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	22.37
n-BUTANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	2.09
n-PENTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	2.95
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	0.60
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.90	0.37	1.00	0.00	1.00	1.00	0.00
T [C]	-30.00	-68.30	-50.10	-97.10	-97.10	-30.80	6.20	-26.50

P [bar]	69.50	30.00	30.00	29.00	29.00	28.50	79.60	29.50
MoleFlow [kgmole/h]	78.84	921.16	78.84	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	1.58	18.50	1.58	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	42.94	827.06	42.94	835.71	0.00	835.71	835.71	34.29
ETHANE [kgmole/h]	12.90	66.10	12.90	0.06	0.00	0.06	0.06	78.94
PROPANE [kgmole/h]	10.63	22.37	10.63	0.00	0.00	0.00	0.00	33.00
n-BUTANE [kgmole/h]	2.51	2.09	2.51	0.00	0.00	0.00	0.00	4.60
n-PENTANE [kgmole/h]	8.35	2.95	8.35	0.00	0.00	0.00	0.00	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	1.50	0.60	1.50	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	0.96	0.96	0.96	1.00
T [C]	35.00	35.00	35.00	-20.00	-20.00	-20.00	-20.00
P [bar]	70.00	70.00	70.00	69.50	69.50	69.50	69.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	956.45
StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	19.20
METHANE [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	849.20
ETHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	72.16
PROPANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	26.76
n-BUTANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	2.86
n-PENTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	4.55
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	0.92
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.92	0.34	1.00	0.00	1.00	1.00	0.00
T [C]	-20.00	-59.70	-37.20	-97.10	-97.10	-37.30	0.50	-26.50
P [bar]	69.50	30.00	30.00	29.00	29.00	28.50	79.60	29.50
MoleFlow [kgmole/h]	43.55	956.45	43.55	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	0.87	19.20	0.87	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	20.80	849.20	20.80	835.70	0.00	835.70	835.70	34.30
ETHANE [kgmole/h]	6.84	72.16	6.84	0.07	0.00	0.07	0.07	78.93
PROPANE [kgmole/h]	6.24	26.76	6.24	0.00	0.00	0.00	0.00	33.00
n-BUTANE [kgmole/h]	1.74	2.86	1.74	0.00	0.00	0.00	0.00	4.60
n-PENTANE [kgmole/h]	6.75	4.55	6.75	0.00	0.00	0.00	0.00	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	1.18	0.92	1.18	0.00	0.00	0.00	0.00	2.10

C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	0.97	0.97	0.97	1.00
T [C]	40.00	40.00	40.00	-15.00	-15.00	-15.00	-15.00
P [bar]	70.00	70.00	70.00	69.50	69.50	69.50	69.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	968.99
StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	19.46
METHANE [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	856.03
ETHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	74.31
PROPANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	28.58
n-BUTANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	3.28
n-PENTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	5.66
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	1.13
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.93	0.33	1.00	0.00	1.00	1.00	0.00
T [C]	-15.00	-55.40	-30.90	-97.10	-97.10	-40.00	-1.80	-26.50
P [bar]	69.50	30.00	30.00	29.00	29.00	28.50	79.60	29.50
MoleFlow [kgmole/h]	31.01	968.99	31.01	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	0.62	19.46	0.62	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	13.97	856.03	13.97	835.70	0.00	835.70	835.70	34.30
ETHANE [kgmole/h]	4.69	74.31	4.69	0.07	0.00	0.07	0.07	78.93
PROPANE [kgmole/h]	4.42	28.58	4.42	0.00	0.00	0.00	0.00	33.00
n-BUTANE [kgmole/h]	1.32	3.28	1.32	0.00	0.00	0.00	0.00	4.60
n-PENTANE [kgmole/h]	5.64	5.66	5.64	0.00	0.00	0.00	0.00	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	0.97	1.13	0.97	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

30% PRESSURE DROP

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.000	1.000	1.000	1.000	1.000	1.000	1.000
T [C]	25.000	25.000	25.000	-30.000	-30.000	-30.000	-30.000
P [bar]	100.000	100.000	100.000	99.500	99.500	99.500	99.500
MoleFlow [kgmole/h]	1000.000	700.000	300.000	700.000	300.000	1000.000	1000.000
StdGasVolumeFlow	20.079	14.055	6.024	14.055	6.024	20.079	20.079

[MMSCFD]							
METHANE [kgmole/h]	870.000	609.000	261.000	609.000	261.000	870.000	870.000
ETHANE [kgmole/h]	79.000	55.300	23.700	55.300	23.700	79.000	79.000
PROPANE [kgmole/h]	33.000	23.100	9.900	23.100	9.900	33.000	33.000
n-BUTANE [kgmole/h]	4.600	3.220	1.380	3.220	1.380	4.600	4.600
n-PENTANE [kgmole/h]	11.300	7.910	3.390	7.910	3.390	11.300	11.300
ISOBUTANE [kgmole/h]	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ISOPENTANE [kgmole/h]	2.100	1.470	0.630	1.470	0.630	2.100	2.100
C6+ [kgmole/h]	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.72	0.82	1.00	0.00	1.00	1.00	0.00
T [C]	-30.00	-78.70	-70.30	-97.10	-97.10	-18.10	12.10	-26.40
P [bar]	99.50	30.00	30.00	29.00	29.00	28.50	69.65	29.50
MoleFlow [kgmole/h]	0.00	1000.00	0.00	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	0.00	20.08	0.00	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	0.00	870.00	0.00	835.72	0.00	835.72	835.72	34.28
ETHANE [kgmole/h]	0.00	79.00	0.00	0.05	0.00	0.05	0.05	78.95
PROPANE [kgmole/h]	0.00	33.00	0.00	0.00	0.00	0.00	0.00	33.00
n-BUTANE [kgmole/h]	0.00	4.60	0.00	0.00	0.00	0.00	0.00	4.60
n-PENTANE [kgmole/h]	0.00	11.30	0.00	0.00	0.00	0.00	0.00	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	0.00	2.10	0.00	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.000	1.000	1.000	1.000	1.000	1.000	1.000
T [C]	35.000	35.000	35.000	-20.000	-20.000	-20.000	-20.000
P [bar]	100.000	100.000	100.000	99.500	99.500	99.500	99.500
MoleFlow [kgmole/h]	1000.000	700.000	300.000	700.000	300.000	1000.000	1000.000
StdGasVolumeFlow [MMSCFD]	20.079	14.055	6.024	14.055	6.024	20.079	20.079
METHANE [kgmole/h]	870.000	609.000	261.000	609.000	261.000	870.000	870.000
ETHANE [kgmole/h]	79.000	55.300	23.700	55.300	23.700	79.000	79.000
PROPANE [kgmole/h]	33.000	23.100	9.900	23.100	9.900	33.000	33.000
n-BUTANE [kgmole/h]	4.600	3.220	1.380	3.220	1.380	4.600	4.600
n-PENTANE [kgmole/h]	11.300	7.910	3.390	7.910	3.390	11.300	11.300
ISOBUTANE [kgmole/h]	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ISOPENTANE [kgmole/h]	2.100	1.470	0.630	1.470	0.630	2.100	2.100
C6+ [kgmole/h]	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.80	0.88	1.00	0.00	1.00	1.00	0.00
T [C]	-20.00	-72.20	-59.30	-97.10	-97.10	-26.90	4.10	-20.00
P [bar]	99.50	30.00	30.00	29.00	29.00	28.50	69.65	99.50
MoleFlow [kgmole/h]	0.00	1000.00	0.00	835.77	0.00	835.77	835.77	0.00
StdGasVolumeFlow [MMSCFD]	0.00	20.08	0.00	16.78	0.00	16.78	16.78	0.00
METHANE [kgmole/h]	0.000	870.000	0.000	835.710	0.000	835.710	835.710	0.000
ETHANE [kgmole/h]	0.000	79.000	0.000	0.056	0.000	0.056	0.056	0.000
PROPANE [kgmole/h]	0.000	33.000	0.000	0.000	0.000	0.000	0.000	0.000
n-BUTANE [kgmole/h]	0.000	4.600	0.000	0.000	0.000	0.000	0.000	0.000
n-PENTANE [kgmole/h]	0.000	11.300	0.000	0.000	0.000	0.000	0.000	0.000
ISOBUTANE [kgmole/h]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ISOPENTANE [kgmole/h]	0.000	2.100	0.000	0.000	0.000	0.000	0.000	0.000
C6+ [kgmole/h]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.000	1.000	1.000	1.000	1.000	1.000	1.000
T [C]	40.000	40.000	40.000	-15.000	-15.000	-15.000	-15.000
P [bar]	100.000	100.000	100.000	99.500	99.500	99.500	99.500
MoleFlow [kgmole/h]	1000.000	700.000	300.000	700.000	300.000	1000.000	1000.000
StdGasVolumeFlow [MMSCFD]	20.079	14.055	6.024	14.055	6.024	20.079	20.079
METHANE [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	870.00
ETHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	79.00
PROPANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	33.00
n-BUTANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	4.60
n-PENTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.83	0.91	1.00	0.00	1.00	1.00	0.00
T [C]	-15.00	-68.70	-53.60	-97.10	-97.10	-30.50	0.90	-26.50
P [bar]	99.50	30.00	30.00	29.00	29.00	28.50	69.65	29.50
MoleFlow [kgmole/h]	0.00	1000.00	0.00	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow	0.00	20.08	0.00	16.78	0.00	16.78	16.78	3.30

[MMSCFD]								
METHANE [kgmole/h]	0.00	870.00	0.00	835.71	0.00	835.71	835.71	34.29
ETHANE [kgmole/h]	0.00	79.00	0.00	0.06	0.00	0.06	0.06	78.94
PROPANE [kgmole/h]	0.00	33.00	0.00	0.00	0.00	0.00	0.00	33.00
n-BUTANE [kgmole/h]	0.00	4.60	0.00	0.00	0.00	0.00	0.00	4.60
n-PENTANE [kgmole/h]	0.00	11.30	0.00	0.00	0.00	0.00	0.00	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	0.00	2.10	0.00	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.000	1.000	1.000	0.921	0.921	0.921	1.000
T [C]	25.000	25.000	25.000	-30.000	-30.000	-30.000	-30.000
P [bar]	70.000	70.000	70.000	69.500	69.500	69.500	69.500
MoleFlow [kgmole/h]	1000.000	700.000	300.000	700.000	300.000	1000.000	921.160
StdGasVolumeFlow [MMSCFD]	20.079	14.055	6.024	14.055	6.024	20.079	18.496
METHANE [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	827.06
ETHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	66.10
PROPANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	22.37
n-BUTANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	2.09
n-PENTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	2.95
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	0.60
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.90	0.37	1.00	0.00	1.00	1.00	0.00
T [C]	-30.00	-68.30	-50.10	-97.10	-97.10	-30.80	0.60	-26.50
P [bar]	69.50	30.00	30.00	29.00	29.00	28.50	69.65	29.50
MoleFlow [kgmole/h]	78.84	921.16	78.84	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	1.58	18.50	1.58	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	42.94	827.06	42.94	835.71	0.00	835.71	835.71	34.29
ETHANE [kgmole/h]	12.90	66.10	12.90	0.06	0.00	0.06	0.06	78.94
PROPANE [kgmole/h]	10.63	22.37	10.63	0.00	0.00	0.00	0.00	33.00
n-BUTANE [kgmole/h]	2.51	2.09	2.51	0.00	0.00	0.00	0.00	4.60
n-PENTANE [kgmole/h]	8.35	2.95	8.35	0.00	0.00	0.00	0.00	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	1.50	0.60	1.50	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.000	1.000	1.000	0.956	0.956	0.956	1.000
T [C]	35.000	35.000	35.000	-20.000	-20.000	-20.000	-20.000
P [bar]	70.000	70.000	70.000	69.500	69.500	69.500	69.500
MoleFlow [kgmole/h]	1000.000	700.000	300.000	700.000	300.000	1000.000	956.450
StdGasVolumeFlow [MMSCFD]	20.079	14.055	6.024	14.055	6.024	20.079	19.204
METHANE [kgmole/h]	870.000	609.000	261.000	609.000	261.000	870.000	849.200
ETHANE [kgmole/h]	79.000	55.300	23.700	55.300	23.700	79.000	72.160
PROPANE [kgmole/h]	33.000	23.100	9.900	23.100	9.900	33.000	26.760
n-BUTANE [kgmole/h]	4.600	3.220	1.380	3.220	1.380	4.600	2.860
n-PENTANE [kgmole/h]	11.300	7.910	3.390	7.910	3.390	11.300	4.550
ISOBUTANE [kgmole/h]	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ISOPENTANE [kgmole/h]	2.100	1.470	0.630	1.470	0.630	2.100	0.922
C6+ [kgmole/h]	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.92	0.34	1.00	0.00	1.00	1.00	0.00
T [C]	-20.00	-59.70	-37.20	-97.10	-97.10	-37.30	-5.20	-26.50
P [bar]	69.50	30.00	30.00	29.00	29.00	28.50	69.65	29.50
MoleFlow [kgmole/h]	43.55	956.45	43.55	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	0.87	19.20	0.87	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	20.80	849.20	20.80	835.70	0.00	835.70	835.70	34.30
ETHANE [kgmole/h]	6.84	72.16	6.84	0.07	0.00	0.07	0.07	78.93
PROPANE [kgmole/h]	6.24	26.76	6.24	0.00	0.00	0.00	0.00	33.00
n-BUTANE [kgmole/h]	1.74	2.86	1.74	0.00	0.00	0.00	0.00	4.60
n-PENTANE [kgmole/h]	6.75	4.55	6.75	0.00	0.00	0.00	0.00	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	1.18	0.92	1.18	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.000	1.000	1.000	0.969	0.969	0.969	1.000
T [C]	40.000	40.000	40.000	-15.000	-15.000	-15.000	-15.000
P [bar]	70.000	70.000	70.000	69.500	69.500	69.500	69.500
MoleFlow [kgmole/h]	1000.000	700.000	300.000	700.000	300.000	1000.000	968.990
StdGasVolumeFlow	870.00	609.00	261.00	609.00	261.00	870.00	856.03

[MMSCFD]							
METHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	74.31
ETHANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	28.58
PROPANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	3.28
n-BUTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	5.66
n-PENTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOBUTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	1.13
ISOPENTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C6+ [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	856.03

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.93	0.33	1.00	0.00	1.00	1.00	0.00
T [C]	-15.00	-55.40	-30.90	-97.10	-97.10	-40.00	-7.50	-26.50
P [bar]	69.50	30.00	30.00	29.00	29.00	28.50	69.65	29.50
MoleFlow [kgmole/h]	31.01	968.99	31.01	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	0.62	19.46	0.62	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	13.97	856.03	13.97	835.70	0.00	835.70	835.70	34.30
ETHANE [kgmole/h]	4.69	74.31	4.69	0.07	0.00	0.07	0.07	78.93
PROPANE [kgmole/h]	4.42	28.58	4.42	0.00	0.00	0.00	0.00	33.00
n-BUTANE [kgmole/h]	1.32	3.28	1.32	0.00	0.00	0.00	0.00	4.60
n-PENTANE [kgmole/h]	5.64	5.66	5.64	0.00	0.00	0.00	0.00	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	0.97	1.13	0.97	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

APPENDIX D

FULL TABULATION OF SIMULATION RESULTS FOR TWISTER SYSTEM – RICH FEED STREAM

20% PRESSURE DROP

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	0.99	0.99	0.99	0.93	0.97	0.96	1.00
T [C]	25.00	25.00	25.00	0.00	15.00	11.75	11.75
P [bar]	100.00	100.00	100.00	99.50	99.50	99.50	99.50
MoleFlow [kgmole/h]	1000.00	790.12	209.88	209.88	790.12	1000.00	964.17
StdGasVolumeFlow [MMSCFD]	60.38	47.71	12.67	12.67	47.71	60.38	57.53
METHANE [kgmole/h]	820.00	647.90	172.10	172.10	647.90	820.00	802.85
ETHANE [kgmole/h]	97.00	76.64	20.36	20.36	76.64	97.00	92.07
PROPANE [kgmole/h]	45.00	35.56	9.44	9.44	35.56	45.00	40.95
n-BUTANE [kgmole/h]	5.00	3.95	1.05	1.05	3.95	5.00	4.21
n-PENTANE [kgmole/h]	18.00	14.22	3.78	3.78	14.22	18.00	13.38
ISOBUTANE [kgmole/h]	5.00	3.95	1.05	1.05	3.95	5.00	4.30
ISOPENTANE [kgmole/h]	4.90	3.87	1.03	1.03	3.87	4.90	3.76
C6+ [kgmole/h]	5.10	4.03	1.07	1.07	4.03	5.10	2.65

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.88	0.46	1.00	0.00	0.13	1.00	0.31
T [C]	11.75	-44.61	-8.53	-44.61	-44.61	-36.85	0.93	-4.51
P [bar]	99.50	30.00	30.00	30.00	30.00	30.00	79.50	29.50
MoleFlow [kgmole/h]	35.83	964.17	35.83	852.62	111.54	147.38	852.62	147.38
StdGasVolumeFlow [MMSCFD]	2.85	57.53	2.85	48.27	9.26	12.11	48.27	12.11
METHANE [kgmole/h]	17.15	802.85	17.15	769.95	32.89	50.05	769.95	50.05
ETHANE [kgmole/h]	4.93	92.07	4.93	66.33	25.74	30.67	66.33	30.67
PROPANE [kgmole/h]	4.05	40.95	4.05	14.75	26.20	30.25	14.75	30.25
n-BUTANE [kgmole/h]	0.79	4.21	0.79	0.45	3.76	4.55	0.45	4.55
n-PENTANE [kgmole/h]	4.62	13.38	4.62	0.38	13.01	17.62	0.38	17.62
ISOBUTANE [kgmole/h]	0.70	4.30	0.70	0.63	3.67	4.37	0.63	4.37
ISOPENTANE [kgmole/h]	1.14	3.76	1.14	0.13	3.62	4.77	0.13	4.77
C6+ [kgmole/h]	2.45	2.65	2.45	0.01	2.64	5.09	0.01	5.09

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	0.96	0.99	0.99	1.00

T [C]	35.00	35.00	35.00	10.00	25.00	21.77	21.77
P [bar]	100.00	100.00	100.00	99.50	99.50	99.50	99.50
MoleFlow [kgmole/h]	1000.00	790.12	209.88	209.88	790.12	1000.00	986.76
StdGasVolumeFlow [MMSCFD]	60.38	47.71	12.67	12.67	47.71	60.38	59.29
METHANE [kgmole/h]	820.00	647.90	172.10	172.10	647.90	820.00	814.13
ETHANE [kgmole/h]	97.00	76.64	20.36	20.36	76.64	97.00	95.27
PROPANE [kgmole/h]	45.00	35.56	9.44	9.44	35.56	45.00	43.53
n-BUTANE [kgmole/h]	5.00	3.95	1.05	1.05	3.95	5.00	4.70
n-PENTANE [kgmole/h]	18.00	14.22	3.78	3.78	14.22	18.00	16.08
ISOBUTANE [kgmole/h]	5.00	3.95	1.05	1.05	3.95	5.00	4.74
ISOPENTANE [kgmole/h]	4.90	3.87	1.03	1.03	3.87	4.90	4.44
C6+ [kgmole/h]	5.10	4.03	1.07	1.07	4.03	5.10	3.87

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.90	0.44	1.00	0.00	0.06	1.00	0.24
T [C]	21.77	-35.69	3.81	-35.69	-35.69	-31.49	7.89	5.88
P [bar]	99.50	30.00	30.00	30.00	30.00	30.00	79.50	29.50
MoleFlow [kgmole/h]	13.24	986.76	13.24	887.14	99.62	112.86	887.14	112.86
StdGasVolumeFlow [MMSCFD]	1.09	59.29	1.09	50.65	8.64	9.73	50.65	9.73
METHANE [kgmole/h]	5.87	814.13	5.87	788.76	25.38	31.24	788.76	31.24
ETHANE [kgmole/h]	1.73	95.27	1.73	75.19	20.08	21.81	75.19	21.81
PROPANE [kgmole/h]	1.47	43.53	1.47	20.35	23.18	24.65	20.35	24.65
n-BUTANE [kgmole/h]	0.30	4.70	0.30	0.77	3.92	4.23	0.77	4.23
n-PENTANE [kgmole/h]	1.92	16.08	1.92	0.76	15.32	17.24	0.76	17.24
ISOBUTANE [kgmole/h]	0.26	4.74	0.26	1.03	3.71	3.97	1.03	3.97
ISOPENTANE [kgmole/h]	0.46	4.44	0.46	0.26	4.17	4.64	0.26	4.64
C6+ [kgmole/h]	1.23	3.87	1.23	0.02	3.85	5.08	0.02	5.08

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	0.97	1.00	1.00	1.00
T [C]	40.00	40.00	40.00	15.00	30.00	26.70	26.70
P [bar]	100.00	100.00	100.00	99.50	99.50	99.50	99.50
MoleFlow [kgmole/h]	1000.00	790.12	209.88	209.88	790.12	1000.00	996.25
StdGasVolumeFlow [MMSCFD]	60.38	47.71	12.67	12.67	47.71	60.38	60.06
METHANE [kgmole/h]	820.00	647.90	172.10	172.10	647.90	820.00	818.40
ETHANE [kgmole/h]	97.00	76.64	20.36	20.36	76.64	97.00	96.52
PROPANE [kgmole/h]	45.00	35.56	9.44	9.44	35.56	45.00	44.59
n-BUTANE [kgmole/h]	5.00	3.95	1.05	1.05	3.95	5.00	4.91

n-PENTANE [kgmole/h]	18.00	14.22	3.78	3.78	14.22	18.00	17.44
ISOBUTANE [kgmole/h]	5.00	3.95	1.05	1.05	3.95	5.00	4.93
ISOPENTANE [kgmole/h]	4.90	3.87	1.03	1.03	3.87	4.90	4.77
C6+ [kgmole/h]	5.10	4.03	1.07	1.07	4.03	5.10	4.70

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.90	0.43	1.00	0.00	0.02	1.00	0.19
T [C]	26.70	-31.22	9.75	-31.22	-31.22	-29.79	11.39	10.00
P [bar]	99.50	30.00	30.00	30.00	30.00	30.00	79.50	29.50
MoleFlow [kgmole/h]	3.75	996.25	3.75	901.49	94.77	98.51	901.49	98.51
StdGasVolumeFlow [MMSCFD]	0.32	60.06	0.32	51.67	8.40	8.71	51.67	8.71
METHANE [kgmole/h]	1.60	818.40	1.60	795.85	22.55	24.15	795.85	24.15
ETHANE [kgmole/h]	0.48	96.52	0.48	78.81	17.72	18.19	78.81	18.19
PROPANE [kgmole/h]	0.41	44.59	0.41	23.14	21.45	21.86	23.14	21.86
n-BUTANE [kgmole/h]	0.09	4.91	0.09	0.98	3.93	4.02	0.98	4.02
n-PENTANE [kgmole/h]	0.56	17.44	0.56	1.05	16.39	16.95	1.05	16.95
ISOBUTANE [kgmole/h]	0.07	4.93	0.07	1.27	3.66	3.73	1.27	3.73
ISOPENTANE [kgmole/h]	0.13	4.77	0.13	0.36	4.40	4.54	0.36	4.54
C6+ [kgmole/h]	0.40	4.70	0.40	0.03	4.67	5.07	0.03	5.07

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	0.98	0.98	0.98	0.93	0.96	0.95	1.00
T [C]	25.00	25.00	25.00	0.00	15.00	11.78	11.78
P [bar]	70.00	70.00	70.00	69.50	69.50	69.50	69.50
MoleFlow [kgmole/h]	1000.00	790.12	209.88	209.88	790.12	1000.00	954.68
StdGasVolumeFlow [MMSCFD]	60.38	47.71	12.67	12.67	47.71	60.38	56.41
METHANE [kgmole/h]	820.00	647.90	172.10	172.10	647.90	820.00	804.60
ETHANE [kgmole/h]	97.00	76.64	20.36	20.36	76.64	97.00	90.80
PROPANE [kgmole/h]	45.00	35.56	9.44	9.44	35.56	45.00	38.77
n-BUTANE [kgmole/h]	5.00	3.95	1.05	1.05	3.95	5.00	3.58
n-PENTANE [kgmole/h]	18.00	14.22	3.78	3.78	14.22	18.00	9.32
ISOBUTANE [kgmole/h]	5.00	3.95	1.05	1.05	3.95	5.00	3.78
ISOPENTANE [kgmole/h]	4.90	3.87	1.03	1.03	3.87	4.90	2.75
C6+ [kgmole/h]	5.10	4.03	1.07	1.07	4.03	5.10	1.08

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.95	0.28	1.00	0.00	0.14	1.00	0.32
T [C]	11.78	-30.35	0.75	-30.35	-30.35	-15.88	12.47	27.01
P [bar]	69.50	30.00	30.00	30.00	30.00	30.00	79.50	29.50

MoleFlow [kgmole/h]	45.32	954.68	45.32	904.16	50.52	95.84	904.16	95.84
StdGasVolumeFlow [MMSCFD]	3.97	56.41	3.97	52.02	4.39	8.36	52.02	8.36
METHANE [kgmole/h]	15.40	804.60	15.40	792.54	12.06	27.46	792.54	27.46
ETHANE [kgmole/h]	6.20	90.80	6.20	81.24	9.57	15.76	81.24	15.76
PROPANE [kgmole/h]	6.23	38.77	6.23	26.21	12.56	18.79	26.21	18.79
n-BUTANE [kgmole/h]	1.42	3.58	1.42	1.18	2.40	3.82	1.18	3.82
n-PENTANE [kgmole/h]	8.68	9.32	8.68	1.07	8.25	16.93	1.07	16.93
ISOBUTANE [kgmole/h]	1.22	3.78	1.22	1.52	2.25	3.48	1.52	3.48
ISOPENTANE [kgmole/h]	2.15	2.75	2.15	0.39	2.36	4.51	0.39	4.51
C6+ [kgmole/h]	4.02	1.08	4.02	0.01	1.07	5.09	0.01	5.09

Name	**Feed Gas**	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**
Vapor Fraction	0.99	0.99	0.99	0.95	0.98	0.97	1.00
T [C]	35.00	35.00	35.00	10.00	25.00	21.80	21.80
P [bar]	70.00	70.00	70.00	69.50	69.50	69.50	69.50
MoleFlow [kgmole/h]	1000.00	790.12	209.88	209.88	790.12	1000.00	973.36
StdGasVolumeFlow [MMSCFD]	60.38	47.71	12.67	12.67	47.71	60.38	57.96
METHANE [kgmole/h]	820.00	647.90	172.10	172.10	647.90	820.00	811.64
ETHANE [kgmole/h]	97.00	76.64	20.36	20.36	76.64	97.00	93.70
PROPANE [kgmole/h]	45.00	35.56	9.44	9.44	35.56	45.00	41.64
n-BUTANE [kgmole/h]	5.00	3.95	1.05	1.05	3.95	5.00	4.19
n-PENTANE [kgmole/h]	18.00	14.22	3.78	3.78	14.22	18.00	12.44
ISOBUTANE [kgmole/h]	5.00	3.95	1.05	1.05	3.95	5.00	4.31
ISOPENTANE [kgmole/h]	4.90	3.87	1.03	1.03	3.87	4.90	3.56
C6+ [kgmole/h]	5.10	4.03	1.07	1.07	4.03	5.10	1.89

Name	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**Sales Gas**	**NGL Product**
Vapor Fraction	0.00	0.95	0.26	1.00	0.00	0.10	1.00	0.30
T [C]	21.80	-20.73	12.13	-20.73	-20.73	-8.90	20.46	43.15
P [bar]	69.50	30.00	30.00	30.00	30.00	30.00	79.50	29.50
MoleFlow [kgmole/h]	26.64	973.36	26.64	926.42	46.94	73.58	926.42	73.58
StdGasVolumeFlow [MMSCFD]	2.42	57.96	2.42	53.69	4.27	6.69	53.69	6.69
METHANE [kgmole/h]	8.36	811.64	8.36	801.84	9.80	18.16	801.84	18.16
ETHANE [kgmole/h]	3.30	93.70	3.30	86.26	7.44	10.74	86.26	10.74
PROPANE [kgmole/h]	3.36	41.64	3.36	31.41	10.23	13.59	31.41	13.59
n-BUTANE [kgmole/h]	0.81	4.19	0.81	1.81	2.38	3.19	1.81	3.19
n-PENTANE [kgmole/h]	5.56	12.44	5.56	2.13	10.30	15.87	2.13	15.87
ISOBUTANE [kgmole/h]	0.69	4.31	0.69	2.19	2.12	2.81	2.19	2.81
ISOPENTANE [kgmole/h]	1.34	3.56	1.34	0.74	2.82	4.16	0.74	4.16

6+ [kgmole/h]	3.21	1.89	3.21	0.04	1.85	5.06	0.04	5.06

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	0.96	0.99	0.98	1.00
T [C]	40.00	40.00	40.00	15.00	30.00	26.80	26.80
P [bar]	70.00	70.00	70.00	69.50	69.50	69.50	69.50
MoleFlow [kgmole/h]	1000.00	790.12	209.88	209.88	790.12	1000.00	981.46
StdGasVolumeFlow MMSCFD]	60.38	47.71	12.67	12.67	47.71	60.38	58.67
METHANE [kgmole/h]	820.00	647.90	172.10	172.10	647.90	820.00	814.39
ETHANE [kgmole/h]	97.00	76.64	20.36	20.36	76.64	97.00	94.81
PROPANE [kgmole/h]	45.00	35.56	9.44	9.44	35.56	45.00	42.77
n-BUTANE [kgmole/h]	5.00	3.95	1.05	1.05	3.95	5.00	4.45
n-PENTANE [kgmole/h]	18.00	14.22	3.78	3.78	14.22	18.00	14.04
ISOBUTANE [kgmole/h]	5.00	3.95	1.05	1.05	3.95	5.00	4.54
ISOPENTANE [kgmole/h]	4.90	3.87	1.03	1.03	3.87	4.90	3.96
C6+ [kgmole/h]	5.10	4.03	1.07	1.07	4.03	5.10	2.50

ame	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
apor Fraction	0.00	0.95	0.26	1.00	0.00	0.08	1.00	0.28
[C]	26.80	-15.84	17.75	-15.84	-15.84	-6.14	24.57	51.60
[bar]	69.50	30.00	30.00	30.00	30.00	30.00	79.50	29.50
MoleFlow [kgmole/h]	18.54	981.46	18.54	935.90	45.56	64.10	935.90	64.10
tdGasVolumeFlow MMSCFD]	1.71	58.67	1.71	54.43	4.24	5.95	54.43	5.95
METHANE [kgmole/h]	5.61	814.39	5.61	805.46	8.93	14.54	805.46	14.54
THANE [kgmole/h]	2.19	94.81	2.19	88.21	6.60	8.79	88.21	8.79
ROPANE [kgmole/h]	2.23	42.77	2.23	33.61	9.16	11.39	33.61	11.39
-BUTANE [kgmole/h]	0.55	4.45	0.55	2.15	2.30	2.85	2.15	2.85
-PENTANE [kgmole/h]	3.96	14.04	3.96	2.88	11.16	15.12	2.88	15.12
SOBUTANE [kgmole/h]	0.46	4.54	0.46	2.53	2.01	2.47	2.53	2.47
SOPENTANE [kgmole/h]	0.94	3.96	0.94	0.98	2.98	3.92	0.98	3.92
C6+ [kgmole/h]	2.60	2.50	2.60	0.07	2.43	5.03	0.07	5.03

30% PRESSURE DROP

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	0.9937	0.9937	0.9937	0.9296	0.9721	0.9642	1
T [C]	25	25	25	0	15	11.7477	11.7477
P [bar]	100	100	100	99.5	99.5	99.5	99.5

MoleFlow [kgmole/h]	1000	790.12	209.88	209.88	790.12	1000	964.17
StdGasVolumeFlow [MMSCFD]	60.379	47.707	12.672	12.672	47.707	60.379	57.531
METHANE [kgmole/h]	820.0	647.9	172.1	172.1	647.9	820.0	802.9
ETHANE [kgmole/h]	97.0	76.6	20.4	20.4	76.6	97.0	92.1
PROPANE [kgmole/h]	45.0	35.6	9.4	9.4	35.6	45.0	41.0
n-BUTANE [kgmole/h]	5.0	4.0	1.1	1.1	4.0	5.0	4.2
n-PENTANE [kgmole/h]	18.0	14.2	3.8	3.8	14.2	18.0	13.4
ISOBUTANE [kgmole/h]	5.0	4.0	1.1	1.1	4.0	5.0	4.3
ISOPENTANE [kgmole/h]	4.9	3.9	1.0	1.0	3.9	4.9	3.8
C6+ [kgmole/h]	5.1	4.0	1.1	1.1	4.0	5.1	2.7

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.88	0.46	1.00	0.00	0.13	1	0.3075
T [C]	11.75	-44.61	-8.53	-44.61	-44.61	-36.85	4.5958	-4.5142
P [bar]	99.50	30.00	30.00	30.00	30.00	30.00	69.5	29.5
MoleFlow [kgmole/h]	35.83	964.17	35.83	852.62	111.54	147.38	852.62	147.38
StdGasVolumeFlow [MMSCFD]	2.85	57.53	2.85	48.27	9.26	12.11	48.269	12.11
METHANE [kgmole/h]	17.15	802.85	17.15	769.95	32.89	50.05	769.95	50.05
ETHANE [kgmole/h]	4.93	92.07	4.93	66.33	25.74	30.67	66.33	30.67
PROPANE [kgmole/h]	4.05	40.95	4.05	14.75	26.2	30.25	14.75	30.25
n-BUTANE [kgmole/h]	0.7912	4.21	0.7912	0.4505	3.76	4.55	0.4505	4.55
n-PENTANE [kgmole/h]	4.62	13.38	4.62	0.378	13.01	17.62	0.378	17.62
ISOBUTANE [kgmole/h]	0.6996	4.3	0.6996	0.6264	3.67	4.37	0.6264	4.37
ISOPENTANE [kgmole/h]	1.14	3.76	1.14	0.1336	3.62	4.77	0.1336	4.77
C6+ [kgmole/h]	2.45	2.65	2.45	0.0062	2.64	5.09	0.0062	5.09

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1	1	1	0.9597	0.9931	0.9868	1
T [C]	35	35	35	10	25	21.7737	21.7737
P [bar]	100	100	100	99.5	99.5	99.5	99.5
MoleFlow [kgmole/h]	1000	790.12	209.88	209.88	790.12	1000	986.76
StdGasVolumeFlow [MMSCFD]	60.379	47.707	12.672	12.672	47.707	60.379	59.286
METHANE [kgmole/h]	820.00	647.90	172.10	172.10	647.90	820.00	814.13
ETHANE [kgmole/h]	97.00	76.64	20.36	20.36	76.64	97.00	95.27
PROPANE [kgmole/h]	45.00	35.56	9.44	9.44	35.56	45.00	43.53
n-BUTANE [kgmole/h]	5.00	3.95	1.05	1.05	3.95	5.00	4.70
n-PENTANE [kgmole/h]	18.00	14.22	3.78	3.78	14.22	18.00	16.08
ISOBUTANE [kgmole/h]	5.00	3.95	1.05	1.05	3.95	5.00	4.74
ISOPENTANE [kgmole/h]	4.90	3.87	1.03	1.03	3.87	4.90	4.44
C6+ [kgmole/h]	5.10	4.03	1.07	1.07	4.03	5.10	3.87

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.90	0.44	1.00	0.00	0.06	1	0.2376
T [C]	21.77	-35.69	3.81	-35.69	-35.69	-31.49	2.4604	5.8755
P [bar]	99.50	30.00	30.00	30.00	30.00	30.00	69.5	29.5
MoleFlow [kgmole/h]	13.24	986.76	13.24	887.14	99.62	112.86	887.14	112.86
StdGasVolumeFlow [MMSCFD]	1.09	59.29	1.09	50.65	8.64	9.73	50.648	9.731
METHANE [kgmole/h]	5.87	814.13	5.87	788.76	25.38	31.24	788.76	31.24
ETHANE [kgmole/h]	1.73	95.27	1.73	75.19	20.08	21.81	75.19	21.81
PROPANE [kgmole/h]	1.47	43.53	1.47	20.35	23.18	24.65	20.35	24.65
n-BUTANE [kgmole/h]	0.3023	4.7	0.3023	0.7749	3.92	4.23	0.7749	4.23
n-PENTANE [kgmole/h]	1.92	16.08	1.92	0.7624	15.32	17.24	0.7624	17.24
ISOBUTANE [kgmole/h]	0.2634	4.74	0.2634	1.03	3.71	3.97	1.03	3.97
ISOPENTANE [kgmole/h]	0.4631	4.44	0.4631	0.2647	4.17	4.64	0.2647	4.64
C6+ [kgmole/h]	1.23	3.87	1.23	0.0173	3.85	5.08	0.0173	5.08

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1	1	1	0.9721	1	0.9963	1
T [C]	40	40	40	15	30	26.6999	26.6999
P [bar]	100	100	100	99.5	99.5	99.5	99.5
MoleFlow [kgmole/h]	1000	790.12	209.88	209.88	790.12	1000	996.25
StdGasVolumeFlow [MMSCFD]	60.379	47.707	12.672	12.672	47.707	60.379	60.064
METHANE [kgmole/h]	820.00	647.90	172.10	172.10	647.90	820.00	818.40
ETHANE [kgmole/h]	97.00	76.64	20.36	20.36	76.64	97.00	96.52
PROPANE [kgmole/h]	45.00	35.56	9.44	9.44	35.56	45.00	44.59
n-BUTANE [kgmole/h]	5.00	3.95	1.05	1.05	3.95	5.00	4.91
n-PENTANE [kgmole/h]	18.00	14.22	3.78	3.78	14.22	18.00	17.44
ISOBUTANE [kgmole/h]	5.00	3.95	1.05	1.05	3.95	5.00	4.93
ISOPENTANE [kgmole/h]	4.90	3.87	1.03	1.03	3.87	4.90	4.77
C6+ [kgmole/h]	5.10	4.03	1.07	1.07	4.03	5.10	4.70

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.90	0.43	1.00	0.00	0.02	1	0.1944
T [C]	26.70	-31.22	9.75	-31.22	-31.22	-29.79	6.0104	10.0019
P [bar]	99.50	30.00	30.00	30.00	30.00	30.00	69.5	29.5
MoleFlow [kgmole/h]	3.75	996.25	3.75	901.49	94.77	98.51	901.49	98.51
StdGasVolumeFlow [MMSCFD]	0.32	60.06	0.32	51.67	8.40	8.71	51.669	8.71
METHANE [kgmole/h]	1.6	818.4	1.6	795.85	22.55	24.15	795.85	24.15

ETHANE [kgmole/h]	0.4751	96.52	0.4751	78.81	17.72	18.19	78.81	18.19
PROPANE [kgmole/h]	0.4075	44.59	0.4075	23.14	21.45	21.86	23.14	21.86
n-BUTANE [kgmole/h]	0.0857	4.91	0.0857	0.9817	3.93	4.02	0.9817	4.02
n-PENTANE [kgmole/h]	0.5632	17.44	0.5632	1.05	16.39	16.95	1.05	16.95
ISOBUTANE [kgmole/h]	0.0742	4.93	0.0742	1.27	3.66	3.73	1.27	3.73
ISOPENTANE [kgmole/h]	0.1347	4.77	0.1347	0.3605	4.4	4.54	0.3605	4.54
C6+ [kgmole/h]	0.4046	4.7	0.4046	0.0286	4.67	5.07	0.0286	5.07

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	0.9786	0.9786	0.9786	0.9271	0.9611	0.9547	1
T [C]	25	25	25	0	15	11.7818	11.7818
P [bar]	70	70	70	69.5	69.5	69.5	69.5
MoleFlow [kgmole/h]	1000	790.12	209.88	209.88	790.12	1000	954.68
StdGasVolumeFlow [MMSCFD]	60.379	47.707	12.672	12.672	47.707	60.379	56.406
METHANE [kgmole/h]	820.00	647.90	172.10	172.10	647.90	820.00	804.60
ETHANE [kgmole/h]	97.00	76.64	20.36	20.36	76.64	97.00	90.80
PROPANE [kgmole/h]	45.00	35.56	9.44	9.44	35.56	45.00	38.77
n-BUTANE [kgmole/h]	5.00	3.95	1.05	1.05	3.95	5.00	3.58
n-PENTANE [kgmole/h]	18.00	14.22	3.78	3.78	14.22	18.00	9.32
ISOBUTANE [kgmole/h]	5.00	3.95	1.05	1.05	3.95	5.00	3.78
ISOPENTANE [kgmole/h]	4.90	3.87	1.03	1.03	3.87	4.90	2.75
C6+ [kgmole/h]	5.10	4.03	1.07	1.07	4.03	5.10	1.08

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.95	0.28	1.00	0.00	0.14	1	0.3241
T [C]	11.78	-30.35	0.75	-30.35	-30.35	-15.88	7.0809	27.0141
P [bar]	69.50	30.00	30.00	30.00	30.00	30.00	69.5	29.5
MoleFlow [kgmole/h]	45.32	954.68	45.32	904.16	50.52	95.84	904.16	95.84
StdGasVolumeFlow [MMSCFD]	3.97	56.41	3.97	52.02	4.39	8.36	52.015	8.364
METHANE [kgmole/h]	15.4	804.6	15.4	792.54	12.06	27.46	792.54	27.46
ETHANE [kgmole/h]	6.2	90.8	6.2	81.24	9.57	15.76	81.24	15.76
PROPANE [kgmole/h]	6.23	38.77	6.23	26.21	12.56	18.79	26.21	18.79
n-BUTANE [kgmole/h]	1.42	3.58	1.42	1.18	2.4	3.82	1.18	3.82
n-PENTANE [kgmole/h]	8.68	9.32	8.68	1.07	8.25	16.93	1.07	16.93
ISOBUTANE [kgmole/h]	1.22	3.78	1.22	1.52	2.25	3.48	1.52	3.48
ISOPENTANE [kgmole/h]	2.15	2.75	2.15	0.3855	2.36	4.51	0.3855	4.51
C6+ [kgmole/h]	4.02	1.08	4.02	0.0134	1.07	5.09	0.0134	5.09

Name	Feed	S1	S2	S3	S4	S5	S6

	Gas						
Vapor Fraction	0.9934	0.9934	0.9934	0.951	0.9786	0.9734	1
T [C]	35	35	35	10	25	21.798	21.798
P [bar]	70	70	70	69.5	69.5	69.5	69.5
MoleFlow [kgmole/h]	1000	790.12	209.88	209.88	790.12	1000	973.36
StdGasVolumeFlow [MMSCFD]	60.379	47.707	12.672	12.672	47.707	60.379	57.959
METHANE [kgmole/h]	820.00	647.90	172.10	172.10	647.90	820.00	811.64
ETHANE [kgmole/h]	97.00	76.64	20.36	20.36	76.64	97.00	93.70
PROPANE [kgmole/h]	45.00	35.56	9.44	9.44	35.56	45.00	41.64
n-BUTANE [kgmole/h]	5.00	3.95	1.05	1.05	3.95	5.00	4.19
n-PENTANE [kgmole/h]	18.00	14.22	3.78	3.78	14.22	18.00	12.44
ISOBUTANE [kgmole/h]	5.00	3.95	1.05	1.05	3.95	5.00	4.31
ISOPENTANE [kgmole/h]	4.90	3.87	1.03	1.03	3.87	4.90	3.56
C6+ [kgmole/h]	5.10	4.03	1.07	1.07	4.03	5.10	1.89

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.95	0.26	1.00	0.00	0.10	1	0.2975
T [C]	21.80	-20.73	12.13	-20.73	-20.73	-8.90	15.2085	43.153
P [bar]	69.50	30.00	30.00	30.00	30.00	30.00	69.5	29.5
MoleFlow [kgmole/h]	26.64	973.36	26.64	926.42	46.94	73.58	926.42	73.58
StdGasVolumeFlow [MMSCFD]	2.42	57.96	2.42	53.69	4.27	6.69	53.689	6.69
METHANE [kgmole/h]	8.36	811.64	8.36	801.84	9.8	18.16	801.84	18.16
ETHANE [kgmole/h]	3.3	93.7	3.3	86.26	7.44	10.74	86.26	10.74
PROPANE [kgmole/h]	3.36	41.64	3.36	31.41	10.23	13.59	31.41	13.59
n-BUTANE [kgmole/h]	0.8115	4.19	0.8115	1.81	2.38	3.19	1.81	3.19
n-PENTANE [kgmole/h]	5.56	12.44	5.56	2.13	10.3	15.87	2.13	15.87
ISOBUTANE [kgmole/h]	0.6885	4.31	0.6885	2.19	2.12	2.81	2.19	2.81
ISOPENTANE [kgmole/h]	1.34	3.56	1.34	0.7402	2.82	4.16	0.7402	4.16
C6+ [kgmole/h]	3.21	1.89	3.21	0.042	1.85	5.06	0.042	5.06

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	0.9999	0.9999	0.9999	0.9611	0.9863	0.9815	1
T [C]	40	40	40	15	30	26.8037	26.8037
P [bar]	70	70	70	69.5	69.5	69.5	69.5
MoleFlow [kgmole/h]	1000	790.12	209.88	209.88	790.12	1000	981.46
StdGasVolumeFlow [MMSCFD]	60.379	47.707	12.672	12.672	47.707	60.379	58.665
METHANE [kgmole/h]	820.00	647.90	172.10	172.10	647.90	820.00	814.39
ETHANE [kgmole/h]	97.00	76.64	20.36	20.36	76.64	97.00	94.81
PROPANE [kgmole/h]	45.00	35.56	9.44	9.44	35.56	45.00	42.77

n-BUTANE [kgmole/h]	5.00	3.95	1.05	1.05	3.95	5.00	4.45
n-PENTANE [kgmole/h]	18.00	14.22	3.78	3.78	14.22	18.00	14.04
ISOBUTANE [kgmole/h]	5.00	3.95	1.05	1.05	3.95	5.00	4.54
ISOPENTANE [kgmole/h]	4.90	3.87	1.03	1.03	3.87	4.90	3.96
C6+ [kgmole/h]	5.10	4.03	1.07	1.07	4.03	5.10	2.50
ame	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
apor Fraction	0.00	0.95	0.26	1.00	0.00	0.08	1	0.2823
[C]	26.80	-15.84	17.75	-15.84	-15.84	-6.14	19.3842	51.6016
[bar]	69.50	30.00	30.00	30.00	30.00	30.00	69.5	29.5
loleFlow [kgmole/h]	18.54	981.46	18.54	935.90	45.56	64.10	935.9	64.1
dGasVolumeFlow MMSCFD]	1.71	58.67	1.71	54.43	4.24	5.95	54.427	5.952
ETHANE [kgmole/h]	5.61	814.39	5.61	805.46	8.93	14.54	805.46	14.54
THANE [kgmole/h]	2.19	94.81	2.19	88.21	6.6	8.79	88.21	8.79
ROPANE [kgmole/h]	2.23	42.77	2.23	33.61	9.16	11.39	33.61	11.39
-BUTANE [kgmole/h]	0.5496	4.45	0.5496	2.15	2.3	2.85	2.15	2.85
-PENTANE [kgmole/h]	3.96	14.04	3.96	2.88	11.16	15.12	2.88	15.12
OBUTANE [kgmole/h]	0.4628	4.54	0.4628	2.53	2.01	2.47	2.53	2.47
OPENTANE [kgmole/h]	0.9403	3.96	0.9403	0.9799	2.98	3.92	0.9799	3.92
6+ [kgmole/h]	2.6	2.5	2.6	0.0734	2.43	5.03	0.0734	5.03

APPENDIX E

FULL TABULATION OF SIMULATION RESULTS FOR TWISTER SYSTEM – NORMAL FEED STREAM

20% PRESSURE DROP

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	0.8159	0.8159	0.8159	0.7199	0.7199	0.7199	1
T [C]	25	25	25	0	0	0	-25
P [bar]	100	100	100	99.5	99.5	99.5	99
MoleFlow [kgmole/h]	1000	790.12	209.88	209.88	790.12	1000	540.08
StdGasVolumeFlow [MMSCFD]	63.325	50.035	13.291	13.291	50.035	63.325	30.668
METHANE [kgmole/h]	789.69	623.95	165.74	165.74	623.95	789.69	493.49
ETHANE [kgmole/h]	71.71	56.66	15.05	15.05	56.66	71.71	28.32
PROPANE [kgmole/h]	29.95	23.67	6.29	6.29	23.67	29.95	8.09
n-BUTANE [kgmole/h]	4.18	3.30	0.88	0.88	3.30	4.18	0.68
n-PENTANE [kgmole/h]	102.57	81.04	21.53	21.53	81.04	102.57	9.31
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	1.91	1.51	0.40	0.40	1.51	1.91	0.20
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.83	1.00	0.00	1.00	0.47	1	0.6144
T [C]	-25.00	-79.99	-79.99	-79.99	-19.48	-59.35	-1.145	-28.6971
P [bar]	99.00	30.00	30.00	30.00	80.00	30.00	79.5	29.5
MoleFlow [kgmole/h]	459.92	540.08	450.81	89.27	450.81	549.19	450.81	549.19
StdGasVolumeFlow [MMSCFD]	32.66	30.67	24.49	6.17	24.49	38.83	24.494	38.831
METHANE [kgmole/h]	296.20	493.49	439.05	54.44	439.05	350.64	439.05	350.64
ETHANE [kgmole/h]	43.39	28.32	10.90	17.42	10.90	60.81	10.90	60.81
PROPANE [kgmole/h]	21.87	8.09	0.81	7.27	0.81	29.14	0.81	29.14
n-BUTANE [kgmole/h]	3.50	0.68	0.01	0.66	0.01	4.16	0.01	4.16
n-PENTANE [kgmole/h]	93.26	9.31	0.03	9.28	0.03	102.54	0.03	102.54
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	1.71	0.20	0.00	0.20	0.00	1.91	0.00	1.91
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	0.85	0.85	0.85	0.76	0.76	0.76	1.00

T [C]	35.00	35.00	35.00	10.00	10.00	10.00	-15.00
P [bar]	100.00	100.00	100.00	99.50	99.50	99.50	99.00
MoleFlow [kgmole/h]	1000.00	790.12	209.88	209.88	790.12	1000.00	634.83
StdGasVolumeFlow MMSCFD]	63.33	50.04	13.29	13.29	50.04	63.33	36.18
METHANE [kgmole/h]	789.69	623.95	165.74	165.74	623.95	789.69	576.40
ETHANE [kgmole/h]	71.71	56.66	15.05	15.05	56.66	71.71	35.49
PROPANE [kgmole/h]	29.95	23.67	6.29	6.29	23.67	29.95	10.35
n-BUTANE [kgmole/h]	4.18	3.30	0.88	0.88	3.30	4.18	0.86
n-PENTANE [kgmole/h]	102.57	81.04	21.53	21.53	81.04	102.57	11.48
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	1.91	1.51	0.40	0.40	1.51	1.91	0.24
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

ame	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
apor Fraction	0.00	0.88	1.00	0.00	1.00	0.43	1.00	0.58
[C]	-15.00	-72.81	-72.81	-72.81	-10.94	-46.62	4.11	-9.76
[bar]	99.00	30.00	30.00	30.00	80.00	30.00	79.50	29.50
loleFlow [kgmole/h]	365.17	634.83	558.48	76.35	558.48	441.52	558.48	441.52
tdGasVolumeFlow MMSCFD]	0.00	0.88	1.00	0.00	1.00	0.43	1.00	0.58
IETHANE [kgmole/h]	213.29	576.40	537.98	38.42	537.98	251.71	537.98	251.71
THANE [kgmole/h]	36.22	35.49	18.65	16.84	18.65	53.06	18.65	53.06
ROPANE [kgmole/h]	19.60	10.35	1.75	8.60	1.75	28.20	1.75	28.20
-BUTANE [kgmole/h]	3.31	0.86	0.03	0.83	0.03	4.15	0.03	4.15
-PENTANE [kgmole/h]	91.09	11.48	0.07	11.41	0.07	102.50	0.07	102.50
SOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOPENTANE [kgmole/h]	1.66	0.24	0.00	0.24	0.00	1.90	0.00	1.90
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	0.87	0.87	0.87	0.78	0.78	0.78	1.00
T [C]	40.00	40.00	40.00	15.00	15.00	15.00	-10.00
P [bar]	100.00	100.00	100.00	99.50	99.50	99.50	99.00
MoleFlow [kgmole/h]	1000.00	790.12	209.88	209.88	790.12	1000.00	668.31
StdGasVolumeFlow MMSCFD]	63.33	50.04	13.29	13.29	50.04	63.33	38.20
METHANE [kgmole/h]	789.69	623.95	165.74	165.74	623.95	789.69	604.16
ETHANE [kgmole/h]	71.71	56.66	15.05	15.05	56.66	71.71	38.55
PROPANE [kgmole/h]	29.95	23.67	6.29	6.29	23.67	29.95	11.46
n-BUTANE [kgmole/h]	4.18	3.30	0.88	0.88	3.30	4.18	0.97
n-PENTANE [kgmole/h]	102.57	81.04	21.53	21.53	81.04	102.57	12.89

ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	1.91	1.51	0.40	0.40	1.51	1.91	0.27
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

ame	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
apor Fraction	0.00	0.89	1.00	0.00	1.00	0.42	1.00	0.56
[C]	-10.00	-68.72	-68.72	-68.72	-6.16	-40.42	8.16	-0.89
[bar]	99.00	30.00	30.00	30.00	80.00	30.00	79.50	29.50
loleFlow [kgmole/h]	331.69	668.31	596.87	71.43	596.87	403.13	596.87	403.13
dGasVolumeFlow MMSCFD]	25.13	38.20	32.74	5.46	32.74	30.59	32.74	30.59
ETHANE [kgmole/h]	185.52	604.16	571.63	32.54	571.63	218.06	571.63	218.06
THANE [kgmole/h]	33.16	38.55	22.66	15.88	22.66	49.04	22.66	49.04
ROPANE [kgmole/h]	18.49	11.46	2.43	9.03	2.43	27.52	2.43	27.52
-BUTANE [kgmole/h]	3.21	0.97	0.04	0.93	0.04	4.13	0.04	4.13
-PENTANE [kgmole/h]	89.68	12.89	0.11	12.78	0.11	102.46	0.11	102.46
OBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OPENTANE [kgmole/h]	1.63	0.27	0.00	0.27	0.00	1.90	0.00	1.90
6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	0.85	0.85	0.85	0.79	0.79	0.79	1.00
T [C]	25.00	25.00	25.00	0.00	0.00	0.00	-25.00
P [bar]	70.00	70.00	70.00	69.50	69.50	69.50	69.00
MoleFlow [kgmole/h]	1000.00	790.12	209.88	209.88	790.12	1000.00	696.61
StdGasVolumeFlow MMSCFD]	63.33	50.04	13.29	13.29	50.04	63.33	38.98
METHANE [kgmole/h]	789.69	623.95	165.74	165.74	623.95	789.69	647.26
ETHANE [kgmole/h]	71.71	56.66	15.05	15.05	56.66	71.71	35.87
PROPANE [kgmole/h]	29.95	23.67	6.29	6.29	23.67	29.95	8.42
n-BUTANE [kgmole/h]	4.18	3.30	0.88	0.88	3.30	4.18	0.50
n-PENTANE [kgmole/h]	102.57	81.04	21.53	21.53	81.04	102.57	4.46
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	1.91	1.51	0.40	0.40	1.51	1.91	0.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

lame	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
apor Fraction	0.00	0.95	1.00	0.00	1.00	0.30	1.00	0.46
[C]	-25.00	-68.55	-68.55	-68.55	-5.98	-43.20	6.09	-1.21
[bar]	69.00	30.00	30.00	30.00	80.00	30.00	79.50	29.50
MoleFlow [kgmole/h]	303.39	696.61	662.28	34.32	662.28	337.72	662.28	337.72
tdGasVolumeFlow MMSCFD]	24.34	38.98	36.42	2.56	36.42	26.91	36.42	26.91

ETHANE [kgmole/h]	142.43	647.26	631.31	15.95	631.31	158.37	631.31	158.37
'HANE [kgmole/h]	35.84	35.87	27.59	8.28	27.59	44.12	27.59	44.12
ROPANE [kgmole/h]	21.54	8.42	3.24	5.18	3.24	26.72	3.24	26.72
-BUTANE [kgmole/h]	3.68	0.50	0.05	0.45	0.05	4.13	0.05	4.13
-PENTANE [kgmole/h]	98.11	4.46	0.09	4.37	0.09	102.48	0.09	102.48
OBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OPENTANE [kgmole/h]	1.80	0.10	0.00	0.10	0.00	1.90	0.00	1.90
6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	0.87	0.87	0.87	0.81	0.81	0.81	1.00
T [C]	35.00	35.00	35.00	10.00	10.00	10.00	-15.00
P [bar]	70.00	70.00	70.00	69.50	69.50	69.50	69.00
MoleFlow [kgmole/h]	1000.00	790.12	209.88	209.88	790.12	1000.00	738.98
StdGasVolumeFlow MMSCFD]	63.33	50.04	13.29	13.29	50.04	63.33	41.65
METHANE [kgmole/h]	789.69	623.95	165.74	165.74	623.95	789.69	679.04
ETHANE [kgmole/h]	71.71	56.66	15.05	15.05	56.66	71.71	41.86
PROPANE [kgmole/h]	29.95	23.67	6.29	6.29	23.67	29.95	10.76
n-BUTANE [kgmole/h]	4.18	3.30	0.88	0.88	3.30	4.18	0.69
n-PENTANE [kgmole/h]	102.57	81.04	21.53	21.53	81.04	102.57	6.50
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	1.91	1.51	0.40	0.40	1.51	1.91	0.15
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

ame	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
apor Fraction	0.00	0.96	1.00	0.00	1.00	0.27	1.00	0.43
[C]	-15.00	-59.36	-59.36	-59.36	4.62	-31.32	16.38	15.78
[bar]	69.00	30.00	30.00	30.00	80.00	30.00	79.50	29.50
loleFlow [kgmole/h]	261.02	738.98	708.61	30.37	708.61	291.39	708.61	291.39
tdGasVolumeFlow MMSCFD]	21.68	41.65	39.22	2.43	39.22	24.11	39.22	24.11
IETHANE [kgmole/h]	110.65	679.04	667.57	11.46	667.57	122.11	667.57	122.11
THANE [kgmole/h]	29.85	41.86	35.15	6.71	35.15	36.56	35.15	36.56
ROPANE [kgmole/h]	19.20	10.76	5.53	5.23	5.53	24.43	5.53	24.43
-BUTANE [kgmole/h]	3.49	0.69	0.11	0.58	0.11	4.06	0.11	4.06
-PENTANE [kgmole/h]	96.07	6.50	0.24	6.26	0.24	102.33	0.24	102.33
SOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOPENTANE [kgmole/h]	1.76	0.15	0.01	0.14	0.01	1.90	0.01	1.90
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	0.89	0.89	0.89	0.82	0.82	0.82	1.00
T [C]	40.00	40.00	40.00	15.00	15.00	15.00	-10.00
P [bar]	70.00	70.00	70.00	69.50	69.50	69.50	69.00
MoleFlow [kgmole/h]	1000.00	790.12	209.88	209.88	790.12	1000.00	756.30
StdGasVolumeFlow MMSCFD]	63.33	50.04	13.29	13.29	50.04	63.33	42.79
METHANE [kgmole/h]	789.69	623.95	165.74	165.74	623.95	789.69	691.03
ETHANE [kgmole/h]	71.71	56.66	15.05	15.05	56.66	71.71	44.53
PROPANE [kgmole/h]	29.95	23.67	6.29	6.29	23.67	29.95	11.96
n-BUTANE [kgmole/h]	4.18	3.30	0.88	0.88	3.30	4.18	0.80
n-PENTANE [kgmole/h]	102.57	81.04	21.53	21.53	81.04	102.57	7.80
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	1.91	1.51	0.40	0.40	1.51	1.91	0.18
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

lame	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
'apor Fraction	0.00	0.96	1.00	0.00	1.00	0.26	1.00	0.42
[C]	-10.00	-54.51	-54.51	-54.51	10.14	-25.63	21.88	23.88
[bar]	69.00	30.00	30.00	30.00	80.00	30.00	79.50	29.50
Aole Flow [kgmole/h]	243.70	756.30	726.78	29.53	726.78	273.22	726.78	273.22
tdGasVolumeFlow MMSCFD]	20.54	42.79	40.35	2.44	40.35	22.97	40.35	22.97
AETHANE [kgmole/h]	98.66	691.03	680.92	10.10	680.92	108.76	680.92	108.76
THANE [kgmole/h]	27.17	44.53	38.47	6.07	38.47	33.24	38.47	33.24
'ROPANE [kgmole/h]	17.99	11.96	6.84	5.12	6.84	23.11	6.84	23.11
-BUTANE [kgmole/h]	3.37	0.80	0.16	0.64	0.16	4.01	0.16	4.01
-PENTANE [kgmole/h]	94.76	7.80	0.37	7.43	0.37	102.19	0.37	102.19
SOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOPENTANE [kgmole/h]	1.73	0.18	0.01	0.17	0.01	1.90	0.01	1.90
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

APPENDIX F

FULL TABULATION OF SIMULATION RESULTS FOR TWISTER SYSTEM – LEAN FEED STREAM

20% PRESSURE DROP

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	1.00	1.00	1.00	1.00
T [C]	25.00	25.00	25.00	-30.00	-30.00	-30.00	-30.00
P [bar]	100.00	100.00	100.00	99.50	99.50	99.50	99.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	1000.00
StdGasVolumeFlow MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	20.08
METHANE [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	870.00
ETHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	79.00
PROPANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	33.00
n-BUTANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	4.60
n-PENTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

ame	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
apor Fraction	0.00	0.72	0.82	1.00	0.00	1.00	1.00	0.00
[C]	-30.00	-78.70	-70.30	-97.10	-97.10	-18.10	17.60	-26.40
[bar]	99.50	30.00	30.00	29.00	29.00	28.50	79.60	29.50
loleFlow [kgmole/h]	0.00	1000.00	0.00	835.77	0.00	835.77	835.77	164.23
tdGasVolumeFlow MMSCFD]	0.00	20.08	0.00	16.78	0.00	16.78	16.78	3.30
AETHANE [kgmole/h]	0.00	870.00	0.00	835.72	0.00	835.72	835.72	34.28
THANE [kgmole/h]	0.00	79.00	0.00	0.05	0.00	0.05	0.05	78.95
ROPANE [kgmole/h]	0.00	33.00	0.00	0.00	0.00	0.00	0.00	33.00
-BUTANE [kgmole/h]	0.00	4.60	0.00	0.00	0.00	0.00	0.00	4.60
-PENTANE [kgmole/h]	0.00	11.30	0.00	0.00	0.00	0.00	0.00	11.30
SOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOPENTANE [kgmole/h]	0.00	2.10	0.00	0.00	0.00	0.00	0.00	2.10
6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	1.00	1.00	1.00	1.00
T [C]	35.00	35.00	35.00	-20.00	-20.00	-20.00	-20.00
P [bar]	100.00	100.00	100.00	99.50	99.50	99.50	99.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	1000.00
StdGasVolumeFlow MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	20.08
METHANE [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	870.00
ETHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	79.00
PROPANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	33.00
n-BUTANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	4.60
n-PENTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

ame	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
apor Fraction	0.00	0.80	0.88	1.00	0.00	1.00	1.00	0.00
[C]	-20.00	-72.20	-59.30	-97.10	-97.10	-26.90	9.70	-26.50
[bar]	99.50	30.00	30.00	29.00	29.00	28.50	79.60	29.50
loleFlow [kgmole/h]	0.00	1000.00	0.00	835.77	0.00	835.77	835.77	164.23
tdGasVolumeFlow MMSCFD]	0.00	20.08	0.00	16.78	0.00	16.78	16.78	3.30
IETHANE [kgmole/h]	0.00	870.00	0.00	835.71	0.00	835.71	835.71	34.29
THANE [kgmole/h]	0.00	79.00	0.00	0.06	0.00	0.06	0.06	78.94
ROPANE [kgmole/h]	0.00	33.00	0.00	0.00	0.00	0.00	0.00	33.00
-BUTANE [kgmole/h]	0.00	4.60	0.00	0.00	0.00	0.00	0.00	4.60
-PENTANE [kgmole/h]	0.00	11.30	0.00	0.00	0.00	0.00	0.00	11.30
SOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOPENTANE [kgmole/h]	0.00	2.10	0.00	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	1.00	1.00	1.00	1.00
T [C]	40.00	40.00	40.00	-15.00	-15.00	-15.00	-15.00
P [bar]	100.00	100.00	100.00	99.50	99.50	99.50	99.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	1000.00
StdGasVolumeFlow MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	20.08
METHANE [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	870.00
ETHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	79.00

PROPANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	33.00
n-BUTANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	4.60
n-PENTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.83	0.91	1.00	0.00	1.00	1.00	0.00
T [C]	-15.00	-68.70	-53.60	-97.10	-97.10	-30.50	6.50	-26.50
P [bar]	99.50	30.00	30.00	29.00	29.00	28.50	79.60	29.50
MoleFlow [kgmole/h]	0.00	1000.00	0.00	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	0.00	20.08	0.00	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	0.00	870.00	0.00	835.71	0.00	835.71	835.71	34.29
ETHANE [kgmole/h]	0.00	79.00	0.00	0.06	0.00	0.06	0.06	78.94
PROPANE [kgmole/h]	0.00	33.00	0.00	0.00	0.00	0.00	0.00	33.00
n-BUTANE [kgmole/h]	0.00	4.60	0.00	0.00	0.00	0.00	0.00	4.60
n-PENTANE [kgmole/h]	0.00	11.30	0.00	0.00	0.00	0.00	0.00	11.30
SOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOPENTANE [kgmole/h]	0.00	2.10	0.00	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	0.92	0.92	0.92	1.00
T [C]	25.00	25.00	25.00	-30.00	-30.00	-30.00	-30.00
P [bar]	70.00	70.00	70.00	69.50	69.50	69.50	69.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	921.16
StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	18.50
METHANE [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	827.06
ETHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	66.10
PROPANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	22.37
n-BUTANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	2.09
n-PENTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	2.95
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	0.60
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.90	0.37	1.00	0.00	1.00	1.00	0.00
T [C]	-30.00	-68.30	-50.10	-97.10	-97.10	-30.80	6.20	-26.50

P [bar]	69.50	30.00	30.00	29.00	29.00	28.50	79.60	29.50
MoleFlow [kgmole/h]	78.84	921.16	78.84	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	1.58	18.50	1.58	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	42.94	827.06	42.94	835.71	0.00	835.71	835.71	34.29
ETHANE [kgmole/h]	12.90	66.10	12.90	0.06	0.00	0.06	0.06	78.94
PROPANE [kgmole/h]	10.63	22.37	10.63	0.00	0.00	0.00	0.00	33.00
n-BUTANE [kgmole/h]	2.51	2.09	2.51	0.00	0.00	0.00	0.00	4.60
n-PENTANE [kgmole/h]	8.35	2.95	8.35	0.00	0.00	0.00	0.00	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	1.50	0.60	1.50	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	0.96	0.96	0.96	1.00
T [C]	35.00	35.00	35.00	-20.00	-20.00	-20.00	-20.00
P [bar]	70.00	70.00	70.00	69.50	69.50	69.50	69.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	956.45
StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	19.20
METHANE [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	849.20
ETHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	72.16
PROPANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	26.76
n-BUTANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	2.86
n-PENTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	4.55
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	0.92
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.92	0.34	1.00	0.00	1.00	1.00	0.00
T [C]	-20.00	-59.70	-37.20	-97.10	-97.10	-37.30	0.50	-26.50
P [bar]	69.50	30.00	30.00	29.00	29.00	28.50	79.60	29.50
MoleFlow [kgmole/h]	43.55	956.45	43.55	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	0.87	19.20	0.87	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	20.80	849.20	20.80	835.70	0.00	835.70	835.70	34.30
ETHANE [kgmole/h]	6.84	72.16	6.84	0.07	0.00	0.07	0.07	78.93
PROPANE [kgmole/h]	6.24	26.76	6.24	0.00	0.00	0.00	0.00	33.00
n-BUTANE [kgmole/h]	1.74	2.86	1.74	0.00	0.00	0.00	0.00	4.60
n-PENTANE [kgmole/h]	6.75	4.55	6.75	0.00	0.00	0.00	0.00	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	1.18	0.92	1.18	0.00	0.00	0.00	0.00	2.10

C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.00	1.00	1.00	0.97	0.97	0.97	1.00
T [C]	40.00	40.00	40.00	-15.00	-15.00	-15.00	-15.00
P [bar]	70.00	70.00	70.00	69.50	69.50	69.50	69.50
MoleFlow [kgmole/h]	1000.00	700.00	300.00	700.00	300.00	1000.00	968.99
StdGasVolumeFlow [MMSCFD]	20.08	14.06	6.02	14.06	6.02	20.08	19.46
METHANE [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	856.03
ETHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	74.31
PROPANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	28.58
n-BUTANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	3.28
n-PENTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	5.66
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	1.13
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
Vapor Fraction	0.00	0.93	0.33	1.00	0.00	1.00	1.00	0.00
T [C]	-15.00	-55.40	-30.90	-97.10	-97.10	-40.00	-1.80	-26.50
P [bar]	69.50	30.00	30.00	29.00	29.00	28.50	79.60	29.50
MoleFlow [kgmole/h]	31.01	968.99	31.01	835.77	0.00	835.77	835.77	164.23
StdGasVolumeFlow [MMSCFD]	0.62	19.46	0.62	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	13.97	856.03	13.97	835.70	0.00	835.70	835.70	34.30
ETHANE [kgmole/h]	4.69	74.31	4.69	0.07	0.00	0.07	0.07	78.93
PROPANE [kgmole/h]	4.42	28.58	4.42	0.00	0.00	0.00	0.00	33.00
n-BUTANE [kgmole/h]	1.32	3.28	1.32	0.00	0.00	0.00	0.00	4.60
n-PENTANE [kgmole/h]	5.64	5.66	5.64	0.00	0.00	0.00	0.00	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	0.97	1.13	0.97	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

30% PRESSURE DROP

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.000	1.000	1.000	1.000	1.000	1.000	1.000
T [C]	25.000	25.000	25.000	-30.000	-30.000	-30.000	-30.000
P [bar]	100.000	100.000	100.000	99.500	99.500	99.500	99.500
MoleFlow [kgmole/h]	1000.000	700.000	300.000	700.000	300.000	1000.000	1000.000
StdGasVolumeFlow	20.079	14.055	6.024	14.055	6.024	20.079	20.079

MMSCFD]							
METHANE [kgmole/h]	870.000	609.000	261.000	609.000	261.000	870.000	870.000
ETHANE [kgmole/h]	79.000	55.300	23.700	55.300	23.700	79.000	79.000
PROPANE [kgmole/h]	33.000	23.100	9.900	23.100	9.900	33.000	33.000
n-BUTANE [kgmole/h]	4.600	3.220	1.380	3.220	1.380	4.600	4.600
n-PENTANE [kgmole/h]	11.300	7.910	3.390	7.910	3.390	11.300	11.300
ISOBUTANE [kgmole/h]	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ISOPENTANE [kgmole/h]	2.100	1.470	0.630	1.470	0.630	2.100	2.100
C6+ [kgmole/h]	0.000	0.000	0.000	0.000	0.000	0.000	0.000

ame	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
apor Fraction	0.00	0.72	0.82	1.00	0.00	1.00	1.00	0.00
[C]	-30.00	-78.70	-70.30	-97.10	-97.10	-18.10	12.10	-26.40
[bar]	99.50	30.00	30.00	29.00	29.00	28.50	69.65	29.50
loleFlow [kgmole/h]	0.00	1000.00	0.00	835.77	0.00	835.77	835.77	164.23
dGasVolumeFlow MMSCFD]	0.00	20.08	0.00	16.78	0.00	16.78	16.78	3.30
IETHANE [kgmole/h]	0.00	870.00	0.00	835.72	0.00	835.72	835.72	34.28
THANE [kgmole/h]	0.00	79.00	0.00	0.05	0.00	0.05	0.05	78.95
ROPANE [kgmole/h]	0.00	33.00	0.00	0.00	0.00	0.00	0.00	33.00
-BUTANE [kgmole/h]	0.00	4.60	0.00	0.00	0.00	0.00	0.00	4.60
-PENTANE [kgmole/h]	0.00	11.30	0.00	0.00	0.00	0.00	0.00	11.30
SOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOPENTANE [kgmole/h]	0.00	2.10	0.00	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.000	1.000	1.000	1.000	1.000	1.000	1.000
T [C]	35.000	35.000	35.000	-20.000	-20.000	-20.000	-20.000
P [bar]	100.000	100.000	100.000	99.500	99.500	99.500	99.500
MoleFlow [kgmole/h]	1000.000	700.000	300.000	700.000	300.000	1000.000	1000.00
StdGasVolumeFlow MMSCFD]	20.079	14.055	6.024	14.055	6.024	20.079	20.079
METHANE [kgmole/h]	870.000	609.000	261.000	609.000	261.000	870.000	870.000
ETHANE [kgmole/h]	79.000	55.300	23.700	55.300	23.700	79.000	79.000
PROPANE [kgmole/h]	33.000	23.100	9.900	23.100	9.900	33.000	33.000
n-BUTANE [kgmole/h]	4.600	3.220	1.380	3.220	1.380	4.600	4.600
n-PENTANE [kgmole/h]	11.300	7.910	3.390	7.910	3.390	11.300	11.300
ISOBUTANE [kgmole/h]	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ISOPENTANE [kgmole/h]	2.100	1.470	0.630	1.470	0.630	2.100	2.100
C6+ [kgmole/h]	0.000	0.000	0.000	0.000	0.000	0.000	0.000

ame	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
apor Fraction	0.00	0.80	0.88	1.00	0.00	1.00	1.00	0.00
[C]	-20.00	-72.20	-59.30	-97.10	-97.10	-26.90	4.10	-20.00
[bar]	99.50	30.00	30.00	29.00	29.00	28.50	69.65	99.50
loleFlow [kgmole/h]	0.00	1000.00	0.00	835.77	0.00	835.77	835.77	0.00
dGasVolumeFlow MMSCFD]	0.00	20.08	0.00	16.78	0.00	16.78	16.78	0.00
ETHANE [kgmole/h]	0.000	870.000	0.000	835.710	0.000	835.710	835.710	0.000
THANE [kgmole/h]	0.000	79.000	0.000	0.056	0.000	0.056	0.056	0.000
ROPANE [kgmole/h]	0.000	33.000	0.000	0.000	0.000	0.000	0.000	0.000
-BUTANE [kgmole/h]	0.000	4.600	0.000	0.000	0.000	0.000	0.000	0.000
-PENTANE [kgmole/h]	0.000	11.300	0.000	0.000	0.000	0.000	0.000	0.000
OBUTANE [kgmole/h]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OPENTANE [kgmole/h]	0.000	2.100	0.000	0.000	0.000	0.000	0.000	0.000
6+ [kgmole/h]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.000	1.000	1.000	1.000	1.000	1.000	1.000
T [C]	40.000	40.000	40.000	-15.000	-15.000	-15.000	-15.000
P [bar]	100.000	100.000	100.000	99.500	99.500	99.500	99.500
MoleFlow [kgmole/h]	1000.000	700.000	300.000	700.000	300.000	1000.000	1000.000
StdGasVolumeFlow MMSCFD]	20.079	14.055	6.024	14.055	6.024	20.079	20.079
METHANE [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	870.00
ETHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	79.00
PROPANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	33.00
n-BUTANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	4.60
n-PENTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	11.30
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

lame	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
apor Fraction	0.00	0.83	0.91	1.00	0.00	1.00	1.00	0.00
[C]	-15.00	-68.70	-53.60	-97.10	-97.10	-30.50	0.90	-26.50
[bar]	99.50	30.00	30.00	29.00	29.00	28.50	69.65	29.50
MoleFlow [kgmole/h]	0.00	1000.00	0.00	835.77	0.00	835.77	835.77	164.23
tdGasVolumeFlow MMSCFD]	0.00	20.08	0.00	16.78	0.00	16.78	16.78	3.30
METHANE [kgmole/h]	0.00	870.00	0.00	835.71	0.00	835.71	835.71	34.29

HANE [kgmole/h]	0.00	79.00	0.00	0.06	0.00	0.06	0.06	78.94
OPANE [kgmole/h]	0.00	33.00	0.00	0.00	0.00	0.00	0.00	33.00
BUTANE [kgmole/h]	0.00	4.60	0.00	0.00	0.00	0.00	0.00	4.60
PENTANE [kgmole/h]	0.00	11.30	0.00	0.00	0.00	0.00	0.00	11.30
OBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OPENTANE [kgmole/h]	0.00	2.10	0.00	0.00	0.00	0.00	0.00	2.10
6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.000	1.000	1.000	0.921	0.921	0.921	1.000
T [C]	25.000	25.000	25.000	-30.000	-30.000	-30.000	-30.000
P [bar]	70.000	70.000	70.000	69.500	69.500	69.500	69.500
MoleFlow [kgmole/h]	1000.000	700.000	300.000	700.000	300.000	1000.000	921.160
StdGasVolumeFlow MMSCFD]	20.079	14.055	6.024	14.055	6.024	20.079	18.496
METHANE [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	827.06
ETHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	66.10
PROPANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	22.37
n-BUTANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	2.09
n-PENTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	2.95
ISOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPENTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	0.60
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00

ame	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
apor Fraction	0.00	0.90	0.37	1.00	0.00	1.00	1.00	0.00
[C]	-30.00	-68.30	-50.10	-97.10	-97.10	-30.80	0.60	-26.50
[bar]	69.50	30.00	30.00	29.00	29.00	28.50	69.65	29.50
loleFlow [kgmole/h]	78.84	921.16	78.84	835.77	0.00	835.77	835.77	164.23
tdGasVolumeFlow MMSCFD]	1.58	18.50	1.58	16.78	0.00	16.78	16.78	3.30
IETHANE [kgmole/h]	42.94	827.06	42.94	835.71	0.00	835.71	835.71	34.29
THANE [kgmole/h]	12.90	66.10	12.90	0.06	0.00	0.06	0.06	78.94
ROPANE [kgmole/h]	10.63	22.37	10.63	0.00	0.00	0.00	0.00	33.00
-BUTANE [kgmole/h]	2.51	2.09	2.51	0.00	0.00	0.00	0.00	4.60
-PENTANE [kgmole/h]	8.35	2.95	8.35	0.00	0.00	0.00	0.00	11.30
SOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOPENTANE [kgmole/h]	1.50	0.60	1.50	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed	S1	S2	S3	S4	S5	S6

	Gas						
Vapor Fraction	1.000	1.000	1.000	0.956	0.956	0.956	1.000
T [C]	35.000	35.000	35.000	-20.000	-20.000	-20.000	-20.000
P [bar]	70.000	70.000	70.000	69.500	69.500	69.500	69.500
MoleFlow [kgmole/h]	1000.000	700.000	300.000	700.000	300.000	1000.000	956.450
StdGasVolumeFlow MMSCFD]	20.079	14.055	6.024	14.055	6.024	20.079	19.204
METHANE [kgmole/h]	870.000	609.000	261.000	609.000	261.000	870.000	849.200
ETHANE [kgmole/h]	79.000	55.300	23.700	55.300	23.700	79.000	72.160
PROPANE [kgmole/h]	33.000	23.100	9.900	23.100	9.900	33.000	26.760
n-BUTANE [kgmole/h]	4.600	3.220	1.380	3.220	1.380	4.600	2.860
n-PENTANE [kgmole/h]	11.300	7.910	3.390	7.910	3.390	11.300	4.550
ISOBUTANE [kgmole/h]	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ISOPENTANE [kgmole/h]	2.100	1.470	0.630	1.470	0.630	2.100	0.922
C6+ [kgmole/h]	0.000	0.000	0.000	0.000	0.000	0.000	0.000

ame	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
apor Fraction	0.00	0.92	0.34	1.00	0.00	1.00	1.00	0.00
[C]	-20.00	-59.70	-37.20	-97.10	-97.10	-37.30	-5.20	-26.50
[bar]	69.50	30.00	30.00	29.00	29.00	28.50	69.65	29.50
oleFlow [kgmole/h]	43.55	956.45	43.55	835.77	0.00	835.77	835.77	164.23
dGasVolumeFlow MMSCFD]	0.87	19.20	0.87	16.78	0.00	16.78	16.78	3.30
ETHANE [kgmole/h]	20.80	849.20	20.80	835.70	0.00	835.70	835.70	34.30
THANE [kgmole/h]	6.84	72.16	6.84	0.07	0.00	0.07	0.07	78.93
ROPANE [kgmole/h]	6.24	26.76	6.24	0.00	0.00	0.00	0.00	33.00
-BUTANE [kgmole/h]	1.74	2.86	1.74	0.00	0.00	0.00	0.00	4.60
-PENTANE [kgmole/h]	6.75	4.55	6.75	0.00	0.00	0.00	0.00	11.30
OBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OPENTANE [kgmole/h]	1.18	0.92	1.18	0.00	0.00	0.00	0.00	2.10
6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Name	Feed Gas	S1	S2	S3	S4	S5	S6
Vapor Fraction	1.000	1.000	1.000	0.969	0.969	0.969	1.000
T [C]	40.000	40.000	40.000	-15.000	-15.000	-15.000	-15.000
P [bar]	70.000	70.000	70.000	69.500	69.500	69.500	69.500
MoleFlow [kgmole/h]	1000.000	700.000	300.000	700.000	300.000	1000.000	968.990
StdGasVolumeFlow MMSCFD]	870.00	609.00	261.00	609.00	261.00	870.00	856.03
METHANE [kgmole/h]	79.00	55.30	23.70	55.30	23.70	79.00	74.31

ETHANE [kgmole/h]	33.00	23.10	9.90	23.10	9.90	33.00	28.58
PROPANE [kgmole/h]	4.60	3.22	1.38	3.22	1.38	4.60	3.28
n-BUTANE [kgmole/h]	11.30	7.91	3.39	7.91	3.39	11.30	5.66
n-PENTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOBUTANE [kgmole/h]	2.10	1.47	0.63	1.47	0.63	2.10	1.13
ISOPENTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C6+ [kgmole/h]	870.00	609.00	261.00	609.00	261.00	870.00	856.03
ame	S7	S8	S9	S10	S11	S12	Sales Gas	NGL Product
apor Fraction	0.00	0.93	0.33	1.00	0.00	1.00	1.00	0.00
[C]	-15.00	-55.40	-30.90	-97.10	-97.10	-40.00	-7.50	-26.50
[bar]	69.50	30.00	30.00	29.00	29.00	28.50	69.65	29.50
loleFlow [kgmole/h]	31.01	968.99	31.01	835.77	0.00	835.77	835.77	164.23
dGasVolumeFlow MMSCFD]	0.62	19.46	0.62	16.78	0.00	16.78	16.78	3.30
IETHANE [kgmole/h]	13.97	856.03	13.97	835.70	0.00	835.70	835.70	34.30
THANE [kgmole/h]	4.69	74.31	4.69	0.07	0.00	0.07	0.07	78.93
ROPANE [kgmole/h]	4.42	28.58	4.42	0.00	0.00	0.00	0.00	33.00
-BUTANE [kgmole/h]	1.32	3.28	1.32	0.00	0.00	0.00	0.00	4.60
-PENTANE [kgmole/h]	5.64	5.66	5.64	0.00	0.00	0.00	0.00	11.30
SOBUTANE [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOPENTANE [kgmole/h]	0.97	1.13	0.97	0.00	0.00	0.00	0.00	2.10
C6+ [kgmole/h]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00